Natalie Novick Brown *Editor*

Evaluating Fetal Alcohol Spectrum Disorders in the Forensic Context

A Manual for Mental Health Practice

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ISBN 978-3-030-73627-9 ISBN 978-3-030-73628-6 (eBook)
https://doi.org/10.1007/978-3-030-73628-6

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Chapter 5
Neuropsychological Assessment of Fetal Alcohol Spectrum Disorder in Adults

Paul D. Connor

Abstract Assessment of current neuropsychological status is an essential component in the fetal alcohol spectrum disorders (FASD) diagnostic process. Because assessment and diagnosis of children with FASD has been occurring routinely for nearly 50 years now, psychometric measures that address this disability in children are fairly well established. By contrast, testing protocols for adults with possible FASD are less well described. The following chapter addresses the body of neuropsychological research in adults with FASD. Based upon this research and formal training in FASD as well as neuropsychology, I describe specific tests found to be sensitive to the effects of prenatal alcohol exposure. The chapter includes specific suggestions for presenting neuropsychological data in reports and testimony in order to make findings more understandable to legal professionals, which includes comparing individual performance to diagnostic guidelines and the FASD empirical literature.

Keywords Fetal alcohol spectrum disorder, FASD · Neurodevelopmental disorder associated with prenatal alcohol exposure, ND-PAE · Neuropsychological assessment

5.1 Introduction

Since fetal alcohol syndrome (FAS) was first identified and described in the United States in 1973 (Jones & Smith, 1973; Jones, Smith, Ulleland, & Streissguth, 1973), a large body of research has been published on the neuropsychological effects of prenatal alcohol exposure. Most of that research focuses on children and early adolescents with relatively little attention to adults with FASD, although it is clear FASD is a lifelong condition caused by permanent brain damage (Bookstein,

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N. Novick Brown (ed.), *Evaluating Fetal Alcohol Spectrum Disorders in the Forensic Context*, https://doi.org/10.1007/978-3-030-73628-6_5

Streissguth, Sampson, Connor, & Barr, 2002; Landgren et al., 2019), and cognitive impairments observed in children persist throughout life. In clinical settings, FASD conditions are diagnosed as fetal alcohol syndrome (FAS), partial FAS (pFAS), or conditions that have no outward physical manifestations: alcohol-related neurodevelopmental disorder (ARND), static encephalopathy/alcohol-exposed (SE/AE), or neurobehavioral disorder/alcohol-exposed (ND/AE). Under the *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (*DSM-5*; American Psychiatric Association (APA), 2013), central nervous system (CNS) dysfunction in FASD is diagnosed as neurodevelopmental disorder associated with prenatal alcohol exposure (ND-PAE). Like all conditions under the FASD umbrella except FAS, ND-PAE requires confirmation of prenatal alcohol exposure.

With varying levels of FASD awareness and limited access to diagnostic services, it is not at all uncommon for individuals who are exposed to alcohol prenatally to "fall through the cracks" and not be diagnosed in childhood. Because FASD was unknown in the United States prior to 1973 and not generally known even in the 1980s, most alcohol-exposed children born in the 1970s and 1980s were never diagnosed. In other words, most children seriously damaged by prenatal alcohol exposure entered adulthood with undiagnosed FASD, often with the condition misattributed to other cognitive or mental health conditions. This under-identification problem has direct implications for adults in the criminal justice system, where it is estimated 17% to perhaps a third of all prison inmates in the United States have FASD (see Chap. 3). Studies examining criminal behavior in FASD find as many as 60% of adults with FASD experience trouble with the law (Forrester et al., 2015; MacPherson, Chudley, & Grant, 2011; Streissguth et al., 2004). A significant risk factor for secondary disabilities (i.e., adverse developmental outcomes) in individuals with FASD is age of diagnosis (Streissguth et al., 2004; Streissguth, Barr, Kogan, & Bookstein, 1996). In fact, diagnosis after age 6 was identified as one of the greatest risk factors for developing secondary disabilities associated with FASD, including mental health disorders, alcohol and drug use problems, trouble with the law, and confinement.

Much of my professional forensic practice has involved adult evaluees suspected of having FASD because maternal alcohol use was either confirmed or likely. During multidisciplinary evaluation, the "gold standard" process for diagnosing FASD (Novick Brown, Wartnik, Connor, & Adler, 2010), neuropsychological assessment typically is the first step. Because of the high-stakes nature of many forensic cases, an empirically based test protocol during neuropsychological assessment is the standard of practice, as described over a decade ago in the peer-reviewed literature (Novick Brown et al., 2010). Since 2010, the forensic assessment protocol for FASD has been updated periodically to remain consistent with the evolving science in FASD. This chapter describes the current forensic protocol for neuropsychological assessment in adults with FASD, along with suggestions for presenting test results in reports and testimony to assist triers of fact in making legal decisions.

5.2 Current Neuropsychological Assessment in the Multidisciplinary Diagnostic Process

In the diagnostic guidelines that have been developed for diagnosing FASD in the clinical context (i.e., American Psychiatric Association (APA), 2013; Astley, 2004; Astley & Clarren, 1999; Bertrand et al., 2004; Chudley et al., 2005; Hoyme et al., 2016; Stratton, Howe, & Battaglia, 1996), neuropsychological impairments are a necessary central component. In the forensic context, if current impairments are found during initial neuropsychological assessment, it then is important to confirm prenatal exposure to alcohol and assess whether cognitive, behavioral, and adaptive impairments manifested across the lifespan. In the case of possible FAS or pFAS, a third step involves medical examination to determine if there are visible physical indicia (i.e., characteristic facial anomalies and growth deficit).

Diagnostic guidelines use neuropsychological assessment protocols that vary in specificity. For example, guidelines for cognitive functioning published by the Institute of Medicine (IOM) note "evidence of a complex pattern of behavior or cognitive abnormalities that are inconsistent with the developmental level and cannot be explained by familial background or environment alone, such as learning difficulties; deficits in school performance; poor impulse control; problems in social perception; deficits in higher-level receptive and expressive language; poor capacity for abstraction or metacognition; specific deficits in mathematical skills; or problems in memory, attention, or judgment" (Stratton et al., 1996, p. 76). Proposed diagnostic guidelines for ND-PAE in *DSM-5* (American Psychiatric Association (APA), 2013) refer only to "impairments" in neurocognitive, self-regulation, and adaptive functioning. However, what constitutes an "impairment" is not defined. It is preferable to have diagnostic criteria that are specific and can be consistently and reliably applied across cases.

Some diagnostic guidelines (Astley, 2004; Bertrand et al., 2004; Chudley et al., 2005) set specific test result cut-points to quantify level of impairment as well as a minimum number of neuropsychological domains that must be impaired to constitute an FASD (typically three). However, cut-points vary among these guidelines. Nonetheless, an advantage of using these diagnostic guidelines is they are more highly structured and thus are amenable to being applied consistently and reliably across cases. For example, if an individual demonstrates deficits in only two functional domains (even if impairments are severe), such a presentation would not be consistent with FASD. By contrast, an individual with mild impairments in seven or eight domains would meet criteria. Although an actuarial method of identifying levels and extent of impairments across domains allows for greater diagnostic consistency, given the disparity in guidelines, clinical judgment and experience in recognizing cognitive-behavioral characteristics associated with FASD are critical.

Diagnostic guidelines from Astley and Clarren (1999), Astley's (2004) updated guidelines, and guidelines from Chudley et al. (2005) set cut-points at 2 or more standard deviations below the mean (≤−2 SD). Several studies have concluded the −2 SD cut-point is too restrictive because it results in an unacceptably high number of false-negative conclusions (Sanders, Hudson Breen, & Netelenbos, 2017; Sanders, Netelenbos, & Dei, 2020). In contrast, using the −1 SD cut-point in the CDC guidelines (Bertrand et al., 2004) allows for detection of FASD in persons with mild as well as moderate and severe levels of cognitive impairment, thereby reducing false-negative error. In such cases, the multidisciplinary protocol described in Novick Brown et al. (2010) as well as this and other chapters of this book (see Chaps. 6, 7, and 8) reduces false-positive error. In forensic practice, limiting both types of error increases trustworthiness of the findings (Du, 2017).

In our earlier FASD multidisciplinary assessment protocol for the forensic context (Novick Brown et al., 2010), we proposed a hybrid model incorporating the IOM diagnostic framework and terminology (Stratton et al., 1996; FAS, pFAS, and ARND) and CDC's more structured diagnostic guidelines (Bertrand et al., 2004) in order to quantify IOM's requirement for a "complex pattern of behavior or cognitive abnormalities…" This hybrid approach has been used in hundreds of forensic cases and described in state, federal, and local testimony across the United States with no legal challenge. Since publication of *DSM-5* (American Psychiatric Association (APA), 2013), I have used a similar approach to operationalize diagnostic criteria for ND-PAE, again without legal challenge.

5.3 Neuropsychological Assessment by Domain

Thorough neuropsychological assessment of possible FASD requires testing in multiple domains of cognitive functioning. Widespread testing is necessary because patterns and profiles of FASD expression are largely dependent upon amount of alcohol consumed (Alvik, Aalen, & Lindemann, 2013; Flak et al., 2014) *and* timing of that exposure (Guerri, Bazinet, & Riley, 2009; Maier & West, 2001). Although some types of cognitive impairment are seen very commonly in individuals with FASD (e.g., deficits in math, attention, and executive functioning), not all individuals with diagnosable FASD have deficits in all of these areas. The following sections review the research on neuropsychological functioning in individuals with FASD by functional domain. Where possible, emphasis is on research with adolescents or adults. Each section concludes with recommendations for tests that can be used to assess the domain.

5.3.1 Intellectual Functioning

FASD often is identified as one of the leading preventable causes of intellectual disability (ID; e.g., Williams & Smith, 2015). Despite this description, only a minority of individuals with FASD actually have intellectual functioning within the ID range. In a large study that included many adolescents and adults with FASD, Streissguth et al. (2004) found an average IQ of 80 (borderline to low-average range) in persons with FAS, only 24% of whom had IQs below 70, historically the cut-point for identifying ID. Those with the equivalent of ARND had an average IQ of 88 (low-average range), and only 7% of this group had IQ scores below 70. In an earlier study involving an even larger sample of children, adolescents, and adults (Streissguth et al., 1996), IQ scores ranged from a low of 29 to a high of 142. Thus, full-scale IQ is not the best predictor of FASD.

Although full-scale IQ is not a predictive measure of FASD, performance variability across domains of intellectual functioning appears to be informative. Connor, Sampson, Bookstein, Barr, and Streissguth (2000) found that for individuals with FAS, Verbal IQ was more than 11 points lower than Performance IQ. For those with fetal alcohol effects (FAE), an outdated term for non-dysmorphic FASD, Verbal IQ was 9 points lower than Performance IQ. In contrast, control subjects demonstrated no such between-domain "split." In a longitudinal Swedish study that followed a group of adoptees diagnosed in childhood with FASD (Landgren et al., 2019), median IQ was 86 in childhood but 71 in early adulthood (median age 22 years), which represented a significant decline in functioning over the years.

The most frequently used IQ measures in studies of individuals with FASD are the Wechsler scales. The current edition of this test for adults is the Wechsler Adult Intelligence Scale, Fourth Edition (WAIS-IV; Wechsler, 2008). In forensic matters, group and abbreviated IQ tests are contraindicated.

5.3.2 Academic Functioning

Disruptions in schooling (suspension, expulsion, dropping out) are extremely common in children with FASD (Popova, Lange, Burd, Nam, & Rehm, 2016; Streissguth et al., 1996; Streissguth et al., 2004). Additionally, people with FASD often need academic assistance. In one study, 42% of individuals with FASD had received special education services, and approximately two-thirds had received some form of remedial assistance with reading and arithmetic (Streissguth et al., 2004). Mathematical abilities appear particularly impacted in FASD (Jacobson, Dodge, Burden, Klorman, & Jacobson, 2011; Kopera-Frye, Dehaene, & Streissguth, 1996; Streissguth et al., 1996) and may be a hallmark indicator of the diagnosis. In one study (Streissguth et al., 1996), people with FAS performed two-thirds of a standard deviation lower than IQ on a test of math calculation, and those with FAE performed nearly one standard deviation below IQ.

There are several tests of academic functioning that are appropriate for using with adults. These tests include the (Woodcock, McGrew, & Mather, 2001); Wechsler Individual Achievement Test, Fourth Edition (WRAT-4; Wilkinson & Robertson, 2006); and Wide Range Achievement Test, Fifth Edition (WRAT-4; Wilkinson & Robertson, 2006). All of these measures assess word pronunciation, reading comprehension, spelling, and math calculation. Because earlier editions of the WRAT were used in research on adults with FASD (Streissguth et al., 1996, 2004), I use the WRAT in my FASD assessment battery.

5.3.3 Attention

Attention deficits often are the earliest noticeable mental health symptoms in children with FASD. For example, in one study (Streissguth et al., 1996), 51% of children age five and under had attention impairments, and attention problems were the most frequent reason for obtaining therapeutic services. Indeed, 61% of children and adolescents and over 40% of adults had histories of attention impairments. A relatively recent study (Mukherjee, Cook, Norgate, & Price, 2019) found high rates of attention-deficit/hyperactivity disorder (ADHD) symptoms in children and adolescents with FASD, 74% of whom had been diagnosed with ADHD. The Swedish longitudinal study referenced earlier found 62% of children with FASD also were diagnosed with ADHD (Landgren et al., 2019), and when the same individuals were assessed again in adulthood, 70% were identified with ADHD, with nearly a quarter of the sample prescribed medication for the condition.

A number of studies have measured visual and/or auditory sustained attention in children and adolescents with FASD (Coles, Platzman, Lynch, & Freides, 2002; Mattson, Calarco, & Lang, 2006; Nanson & Hiscock, 1990), with fewer studies examining these skills in adults (Bookstein et al., 2002; Connor, Streissguth, Sampson, Bookstein, & Barr, 1999; Kerns, Don, Mateer, & Streissguth, 1997). In a study that compared attention in persons with FASD and controls, those with FASD were less efficient and made more omission errors (failing to respond to a stimuli; Coles et al., 2002). In a similar study, Mattson et al. (2006) found poor accuracy and slower reaction times. Variability in reaction time for both visual and auditory stimuli has been found in both adolescents (Coles et al., 2002) and adults (Connor et al., 1999) with FASD.

With respect to test instruments, most of the research on attention control in FASD has focused on sustained attention. Relatively short tasks, such as Digit Span from the WAIS-IV (Wechsler, 2008) and Digit Vigilance Test (Heaton, Grant, & Matthews, 1991; Lewis & Rennick, 1979) may not be long enough to assess effectively for ability to sustain attention. Furthermore, these tests do not include assessment of response time speed or variability, key features found in the research to be affected by prenatal alcohol exposure. In contrast, computerized measures such as the Conners Continuous Performance Test, now in its third edition (CPT-3; Conners, 2014), the Conners Auditory Test of Attention (CATA; Conners, 2014), or Test of Variables of Attention (TOVA; Leark, Greenberg, Kindschi, Dupuy, & Hughes, 2007) are preferable, as these tests measure for multiple types of error as well as timing and pattern of responding over the course of the task.

5.3.4 Visuospatial Construction

Impairments in visuospatial perception and construction usually are found in FASD (Connor, Baldwin, Barr, Huggins, & Streissguth, 2004; Mattson, Gramling, Riley, Delis, & Jones, 1996; Uecker & Nadel, 1996). For example, one study (Uecker &

Nadel, 1996) found children with FASD were able to remember objects they had been shown but could not identify where the objects had been placed, indicating impairment in spatial awareness. Similarly, Kaemingk and Halverson (2000) found that once visuospatial perceptual abilities were taken into account, there was no difference between control subjects and those with FASD in spatial memory performance. In a third study (Mattson, Gramling, Riley, et al., 1996), children with FASD had greater difficulty reproducing and remembering small details relative to larger components. In a study of adults (Connor et al., 2004) who were administered the Rey Complex Figure Test (RCFT; Meyers & Meyers, 1995), participants with FASD were significantly less able than controls to accurately draw a complex figure. Results of this study indicated good sensitivity and specificity at differentiating adults with FASD from those without FASD.

Several measures assess visuospatial construction abilities. Some of these instruments, including the Brief Visuospatial Memory Test-Revised (BVMT-R; Benedict, 1997) and Beery Visual-Motor Integration Test (VMI; Beery, Buktenica, & Beery, 2010) assess visuospatial construction skills by having examinees draw relatively simple geometric designs. Other measures such as Repeatable Battery for Neuropsychological Status (RBANS; Randolph, 1998) and RCFT (Meyers & Meyers, 1995) use relatively complex designs with smaller details, which requires more organization skills. Simple measures may produce more false-negative results than more complex measures. For this reason and because the measure has proven itself in research on adults with FASD, the RCFT measure is recommended in forensic settings.

5.3.5 Learning and Memory

Many studies of individuals with FASD have found impairments in language-based learning and memory. In one such study of children with FASD, researchers found impairments in learning lists of words, although study participants were able to retain what they had learned (Mattson, Riley, Delis, Stern, & Jones, 1996). Studies have found that children with FASD have particular difficulty with perseveration (repeating the same word multiple times) and intrusions (adding words not included on the target list; Gibbard, Wass, & Clarke, 2003; Mattson, Riley, Delis, et al., 1996; Pei, Rinaldi, Rasmussen, Massey, & Massey, 2008). In adults, a similar pattern of impairments in learning and memory was found on a list learning task (Bookstein et al., 2002). Contextual or story-based learning also has been identified as an area of impairment for adults with FASD (Novick Brown, Gudjonsson, & Connor, 2011). In this latter study, adults with FASD demonstrated significantly poor immediate and delayed recall of a simple story compared to control subjects.

Visuospatial learning and memory problems also have been found in research on individuals with prenatal exposure and FASD (Gray & Streissguth, 1990; Streissguth, Barr, Sampson, & Bookstein, 1994). For example, children with FAS performed less well than control subjects on a maze learning task (Gray & Streissguth, 1990).

The same test was found to be more sensitive than other short-term memory tasks in individuals with high levels of prenatal alcohol exposure (Streissguth et al., 1994). Another study using the same maze learning task found that in addition to impairments in learning and memory, persons with FAS made many perseverative errors and took longer to learn the maze pattern than control subjects (Olson, Feldman, Streissguth, Sampson, & Bookstein, 1998). Uecker and Nadel (1996) found that while children with FAS were able to remember familiar objects, they showed impairment in ability to recall the spatial arrangement of those objects.

With respect to test instruments, child and adult versions of the California Verbal Learning Test (CVLT; Delis, Kramer, Kaplan, & Ober, 2017) have been used extensively in research on individuals with FASD. Therefore, CVLT-3 is a good test to use with adults when assessing language-based list learning abilities. The Gudjonsson Suggestibility Scale (GSS; Gudjonsson, 1997) is effective for assessing contextual learning and memory and has the added advantage of also assessing suggestibility, which often is impaired in FASD (see more discussion below). Visuospatial memory can be assessed by using either the BVMT-R (Benedict, 1997) or memory components of the RCFT (Meyers & Meyers, 1995). Since the RCFT is the recommended task for assessing visuospatial construction (see previous discussion), adding the memory components of this test would be appropriate and efficient.

5.3.6 Motor Coordination

Motor coordination impairments in children and adults are found in the FASD literature. Although generally, motor coordination may not be a particularly important issue to address in criminal proceedings, it is a very important domain in FASD assessment. In their review of the FASD literature, Doney et al. (2014) found complex fine motor skills were impaired more often than basic fine motor skills, especially in individuals exposed in utero to moderate-to-high levels of alcohol. Gross motor impairments also have been found in a study of children with FASD (Lucas et al., 2016), as have difficulties with postural balance (Roebuck, Simmons, Mattson, & Riley, 1998). Landgren et al. (2019) found 47% of the young adults they had been following since childhood exhibited dysdiadochokinesis (difficulty making rapidly alternating movements, particularly with the limbs), and 16% showed disturbances in balance. Similar deficits have been observed in adults (Connor, Sampson, Streissguth, Bookstein, & Barr, 2006). In this latter study, adults with FASD exhibited greater difficulty with fine motor control, diadochokinesis, finger tapping and sequencing, and balance than neurotypical individuals. Notably, impairments in motor coordination in this study were associated with significant thinning of the corpus callosum (Bookstein et al., 2002).

Many measures of fine and gross motor coordination described in the FASD literature are research instruments that have not been developed or marketed for neuropsychological assessment purposes. However, there are some clinically available tests that address some of the motor control problems found in the research. For example, Finger Tapping (FT) and Grooved Pegboard (GP) (Heaton et al., 1991) are two well-established and clinically available tests of fine motor coordination and as such are recommended as components in an FASD test battery.

5.3.7 Processing Speed

Processing speed impairment is associated with many neurological conditions as well as FASD, including traumatic brain injury, stroke, and multiple sclerosis. For example, Burden, Jacobson, and Jacobson (2005) found children exposed to prenatal alcohol demonstrated slower processing speed and efficiency. Slow processing speed was particularly evident on tasks requiring pronounced mental effort but were less prominent on tasks requiring more automatic responding. In a neurological study, children with FASD showed slower event-related potential latencies than control subjects (Burden et al., 2009). In a study of adolescents with FASD, researchers found poorer processing speed and accuracy in adolescents with FAS compared to healthy controls (Olson et al., 1998).

Several tasks embedded in measures comprising the proposed neuropsychological assessment battery for FASD address processing speed. Such tasks include the reaction time score from CPT-3 (Conners, 2014), Trails A (Heaton et al., 1991) and word-reading and color-naming tasks in the Stroop Color Word Test (STROOP; Golden & Freshwater, 2002). In addition, processing speed index on the WAIS-IV (Wechsler, 2008) is a proxy measure.

5.3.8 Executive Functioning and Suggestibility

Executive functions are described as future-oriented integrative abilities (Denckla, 1996). Eslinger (1996) described executive functions as a group of cognitive abilities that include self-regulation, sequencing, cognitive flexibility, inhibition, planning, and organization. Rather than a solitary construct, executive functioning embodies a group of skills that rely on more basic abilities in order to achieve goals.

One aspect of executive functioning is idea generation. Compared to control subjects, both children and adults with FASD generate fewer words based on letter cues (Connor et al., 2000; Kodituwakku et al., 2006; Kodituwakku, Handmaker, Cutler, Weathersby, & Handmaker, 1995). Research also has found that compared with controls, people with FASD demonstrate poorer visuospatial idea generation when asked to create as many unique designs as possible (Connor et al., 2000; Kerns et al., 1997). Working memory, which involves holding bits of information in mind while manipulating that information, is a specific executive function skill that often is impaired in children with FASD (Kodituwakku et al., 1995) as well as adults (Connor et al., 2000). Response inhibition impairments also have been documented in individuals with FASD (Connor et al., 2000; Mattson, Goodman, Caine, Delis, &

Riley, 1999). Impairments in cognitive flexibility and set shifting, ability to quickly and easily switch focus of attention, have been documented in individuals with FASD. In particular, research finds that when adults are asked to alternate rules on a task of visual scanning, those with FASD perform more slowly and make more errors than control subjects (Connor et al., 2000). Planning, problem-solving, reasoning, and perseveration are core areas of executive functioning that tend to be impaired in children and adults with FASD (Astley et al., 2009; Bookstein et al., 2002; Connor et al., 2000; Kodituwakku et al., 1995; Mattson et al., 1999; Rangmar, Dahlgren Sandberg, Aronson, & Fahlke, 2015). Compared to control subjects, those with FASD tend to do less preplanning, break rules more often, get stuck on an unsuccessful strategy (perseveration), and employ less efficient problem-solving than controls (Connor et al., 2000; Kodituwakku et al., 1995; Mattson et al., 1999). Notably, those with FASD also demonstrate significantly more impairment as tasks increase in difficulty (Green et al., 2009).

One aspect of executive functioning that has not been well researched is suggestibility, despite research indicating people with FASD are quite gullible and easily led by others (Clark, Lutke, Minnes, & Ouellette-Kuntz, 2004; Streissguth, Bookstein, Barr, Press, & Sampson, 1998). Thought to contribute to the high rate of trouble with the law found in FASD (Streissguth et al., 1996; Streissguth et al., 2004), interrogative suggestibility has direct implications regarding case outcomes when suspects with FASD are interviewed by police officers, as described by Gudjonsson and Clark (1986). In fact, there is considerable concern about the potential for false or exaggerated confessions in this population (Conry & Fast, 2000; Fast & Conry, 2004; Pollard et al., 2004). Novick Brown et al. (2011) assessed these issues in a pilot study. Upon initial questioning, adults with FASD were not more likely to endorse misleading information compared to normative data. However, when told they had made errors and questioning would need to be repeated, they were significantly more likely to change their responses, indicating a tendency to acquiesce to this mild pressure. Overall, adults with FASD in the sample exhibited a significant level of suggestibility.

Because of the many aspects of executive functioning, multiple tests are recommended. Language-based idea generation can be assessed with the Controlled Oral Word Association Test (COWAT; Heaton et al., 1991), and visuospatial idea generation can be investigated with Ruff's Figural Fluency Test (RFF; Ruff, 1996). A clinically available working memory test is the Paced Auditory Serial Addition Test (PASAT; Gronwall, 1977). However, this test requires considerable math ability, an area of particular difficulty for individuals with FASD (Streissguth et al., 1996). Therefore, Auditory Consonant Trigrams Test (ACT) is a better measure (Stuss, Stethem, & Pelchat, 1988; Stuss, Stethem, & Poirier, 1987). To assess set shifting, Trails B (Heaton et al., 1991) is recommended. The Test of General Reasoning Abilities (TOGRA; Reynolds, 2014) also assesses switching in the context of reasoning and problem-solving, as the test requires quickly changing focus among language-based, visuospatial, and mathematical tasks. Many FASD studies use the STROOP (Golden & Freshwater, 2002) to assess response inhibition. Because planning and problem-solving skills are critical executive function skills that are particularly difficult for persons with FASD, several tests are recommended. Wisconsin Card Sorting Test (WCST) (Heaton, 2005) is used frequently in FASD to measure planning, problem-solving, adaptability, and perseveration. Also recommended are the Delis-Kaplan Executive Function System (D-KEFS) Proverbs task for verbal abstract reasoning and Tower task for visuospatial sequential planning (Delis, Kaplan, & Kramer, 2001). As noted, the previously mentioned TOGRA not only is helpful in assessing facile shifting of attention in problem-solving but also can detect problems with processing speed. Finally, the GSS (Gudjonsson, 1997) is recommended to assess for suggestibility.

5.3.9 Adaptive Functioning

Adaptive functioning, or ability to independently apply knowledge on a day-to-day basis, is crucial for successful independent living. Typically, adaptive functioning is assessed with structured interviews of collateral respondents (e.g., parents, caregivers, or others) regarding evaluee behavior. One such assessment is the Vineland Adaptive Behavior Scales, now in the third edition (Vineland-3; Sparrow, Cicchetti, & Saulnier, 2016). Many studies using the Vineland have found adaptive impairments in FASD (Jirikowic, Kartin, & Olson, 2008; Streissguth et al., 1991; Streissguth et al., 1996; Streissguth et al., 2004). In addition to respondent reports of impairments in adaptive functioning, several measures directly test various aspects of adaptive functioning, such as social cognition and recognition of emotion, prosody (tone of voice), and facial expression (Greenbaum, Stevens, Nash, Koren, & Rovet, 2009; Kerns, Siklos, Baker, & Müller, 2016; Monnot, Lovallo, Nixon, & Ross, 2002).

Vineland-3 (Sparrow et al., 2016), an adaptive measure that has been used extensively in FASD research, can be administered to respondents who have observed evaluee behavior on a regular basis. Items on the Vineland consist of behaviors in three adaptive domains (communications, daily living skills, and socialization). Respondents rate how often they have observed the evaluee performing the behavior (i.e., often/always, sometimes, or never). In the case of retrospective assessment, the Vineland-3 manual (Sparrow et al., 2016) recommends administering the measure to two or more respondents to determine consistency. In addition to multiple respondents, directly testing primary adaptive domains in an evaluee at the time of cognitive assessment provides another way to cross-check consistency with Vineland results. For example, the Neuropsychological Assessment Battery: Auditory Comprehension test (NAB:AC; Stern & White, 2003) could be used to directly measure receptive communication skills, instruction following, and ability to understand and properly respond to convoluted questions. Expressive and receptive communication skills can be assessed directly with the Vocabulary Assessment Scales (VAS; Gerhardstein Nader, 2013). The Texas Functional Living Scale (TFLS; Cullum, Weiner, & Saine, 2009) or Independent Living Scales (ILS; Persel, 2012) are recommended for directly measuring day-to-day practical skills, although both instruments are slightly dated. Finally, in order to assess social functioning including emotion regulation, facial expression, and prosody, Advanced Clinical Solutions' Social Cognition test (ACS:SC; Pearson, 2009) is recommended.

5.4 Recommended Test Battery

As noted, many of the tests described in this chapter are recommended in a neuropsychological test battery because versions of the specific tests were used in research on adults with FASD. These tests include WAIS, WRAT, CVLT, GSS, RCFT, WCST, COWAT, RFF, STROOP, ACT, and Vineland. Although the other tests in the proposed battery (Table 5.1) have not been included in FASD research studies, they are included because they address skills and abilities known to be affected in FASD. The battery of tests below is recommended for use in forensic evaluations that address whether evaluees exhibit cognitive and adaptive functioning characteristic of FASD.

5.5 Presenting Test Results

When presenting complicated data, it often is helpful to triers of fact to receive information in more than one modality. For example, one way to present test data in a report is to list standardized scores, with mean and standard deviation for each test (e.g., reporting an evaluee's Full-Scale IQ score and noting that the mean or average score for the test is 100 with a standard deviation of 15). This allows readers of neuropsychological evaluation reports to calculate how far from the mean a particular score is, which is fine for psychologists or others familiar with test score normative data and varying scales of normative data (e.g., T-scores, z-scores, scaled scores). However, as the target audience for neuropsychological reports in forensic assessments is triers of fact with varying levels of statistical knowledge, normative data should be described in lay terms, so it is easily understandable. For example, a T-score of 29 (mean = 50, standard deviation = 10) might be described as performance within the "moderately impaired range." Deviations from the mean and percentiles also could be provided, with interpretations regarding direction of strength or weakness. It is important in such cases to present "cut-points" or thresholds used in making interpretive statements to help readers contextualize levels of functioning, such as the guide in Table 5.2:

A third, and arguably the best, way to present test data so it is easy for legal professionals and juries to understand is visual representations in graph or table format. For example, Fig. 5.1 is a graphical representation of an evaluee's pattern of performance on a forensic test battery. In creating the graph, all test scores are converted to standardized scores (z-scores) wherein mean or average score on each test is 0 with a standard deviation of 1. By doing such a conversion, results from tests with

Table 5.1 Test battery recommended in neuropsychological assessment for possible FASD

Domain	Instrument	Developer
Intellectual functioning	Wechsler Adult Intelligence Scale—Fourth Edition (WAIS-IV)	Wechsler, (2008)
Academic achievement	Wide Range Achievement Test—Fifth Edition (WRAT-5)	Wilkinson & Robertson (2006)
Memory	California Verbal Learning Test—Third Edition (CVLT-3)	Delis et al. (2017)
	Gudjonsson Suggestibility Scale–2 (Gss-2)—Story Learning	Gudjonsson (1997)
	Rey Complex Figure Test (RCFT)	Meyers & Meyers (1995)
Attention	Conners' Continuous Performance Test—Third Edition (CPT-3)	Conners (2014)
Motor coordination	Grooved Pegboard Test (GP)	Heaton et al. (1991)
	Finger Tapping Test (FT)	Heaton et al. (1991)
Executive functioning	Wisconsin Card Sorting Test—Fourth Edition (WCST-4)	Heaton, (2005)
	Delis-Kaplan Executive Function System (D-KEFS) Tower Test & Proverbs Test	Delis et al. (2001)
	Test of General Reasoning Abilities (TOGRA)	Reynolds (2014)
	Controlled Oral Word Association Test (COWAT)	Heaton et al. (1991)
	Ruff's Figural Fluency Test (RFF)	Ruff (1996)
	Stroop Color and Word Test (STROOP)	Golden & Freshwater (2002)
	Trail Making Test (TMT)	Heaton et al. (1991)
	Auditory Consonant Trigrams Test (ACT)	Stuss et al. (1988) Stuss et al. (1987)
	Gudjonsson Suggestibility Scale—2 (GSS-2)	Gudjonsson, (1997)
Adaptive functioning	Vineland Adaptive Behavior Scales—Third Ed. (Vineland-3)	Sparrow et al. (2016)
	NAB: Auditory Comprehension (NAB:AC)	Stern & White (2003)
	ACS: Social Cognition (ACS:SC)	Pearson, (2009)
	Texas Functional Living Scale (TFLS)	Cullum et al., (2009)
Effort & malingering	Combination of Several Tests, Both Stand Alone and Embedded within Other Tests	

different normative scales can be compared easily to each other on an apples-to-apples basis that is further adjusted by making the direction of deficit consistent for all of the tests (i.e., lower scores = poorer performance). The graph is subdivided by functional domains listed across the top of the graph, with individual tests listed across the bottom. In order to help readers orient to the z-scale, the horizontal green line represents average performance on all of the tests. Consistent with CDC guidelines (Bertrand et al., 2004) described earlier in this chapter, the horizontal red line depicts impaired functioning (i.e., −2 SD for intellectual testing and −1 SD for all other tests). The evaluee's performance on each test is shown by a blue dot above

Table 5.2 A descriptive guide to performance level

Performance range	Context
Superior	At least 97% of the population did more poorly
High average	At least 84% of the population did more poorly
Average	Approximately 50% of the population performed above/below
Low average	At least 73% of the population performed better
Borderline	At least 84% of the population performed better
Mildly impaired	At least 86% of the population performed better
Mildly-to-moderately impaired	At least 95% of the population performed better
Moderately impaired	At least 98% of the population performed better
Moderately-to-severely impaired	At least 99.5% of the population performed better
Severely impaired	At least 99.9% of the population performed better

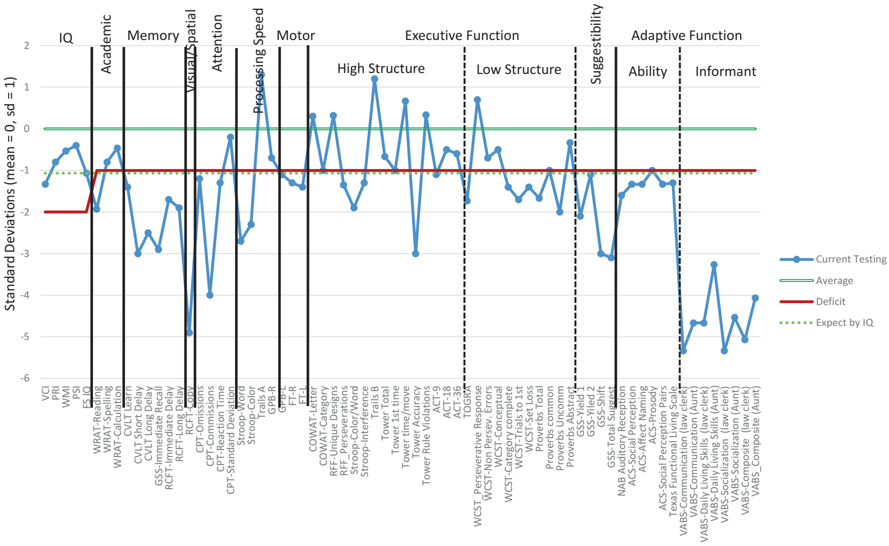

Fig. 5.1 Scores on a neuropsychological test battery shown in graphical format

the test, with connecting lines to show overall performance pattern. Finally, the horizontal dotted green line represents Full-Scale IQ, so performance on other tests can be compared to it.

Graphical presentation of test results makes it easy to understand an evaluee's relative strengths and weaknesses. For example, in Fig. 5.1, the evaluee's test performance reflects significant deficits in 10 domains (academics, memory, visuospatial construction, attention, motor coordination, processing speed, executive functioning, and all three aspects of adaptive functioning). Visuospatial construction performance is particularly deficient (i.e., −5 SD), as can be seen by comparing the test result to the z-scale on the left. Using a graphical presentation of test data such as Fig. 5.1 also clarifies variable performance across tests, which is a hallmark finding in FASD (Sheliza, Kerns, Mulligan, Olson, & Astley, 2018). Additional graphs can be used to demonstrate test performance patterns often seen in FASD. One such pattern is variability across domains of intellectual functioning (Connor et al., 2000), which is depicted in Fig. 5.2.

Research has shown that children, adolescents, and adults with FASD tend to perform worse than expected on academic achievement tests in relation to level of intellectual functioning. Furthermore, day-to-day adaptive functioning often is even more impacted (Streissguth et al., 1996). This downward decline in functioning from intellectual to academic skills and then to adaptive functioning is a rather consistent pattern in FASD. Indeed, in many cases, even when IQ is in the average range, persons with FASD typically exhibit adaptive behavior that falls within the intellectually disabled range (Greenspan, Novick Brown, & Edwards, 2016). Figure 5.3 graphically represents this characteristic downward slope.

The left side of Fig. 5.3 shows average test scores for IQ, Academic, and Adaptive Functioning in research with a large FASD sample (Streissguth et al., 1996). The right side of Fig. 5.3 shows an evaluee's performance on the same tests. This side-by-side juxtaposition allows for comparison of an evaluee's test pattern with the characteristic FASD pattern. In this case, the downward pattern of test results in this individual (i.e., performing much worse than predicted by IQ) is consistent with the research.

Apart from determining whether evaluees exhibit the characteristic downward sloping pattern found in the FASD research, graphical representations of test data also can be illustrative (and therefore helpful to triers of fact) in showing consistency or inconsistency when multiple similar assessments have been administered over time (Fig. 5.4).

Generally, graphical representations of test data help judges and juries "see" the patterns of relative strengths and impairments in evaluees. Once oriented to the

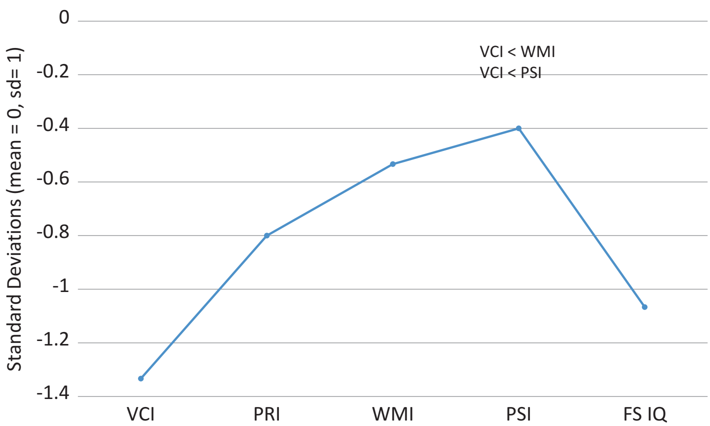

Fig. 5.2 Graphical representation of an evaluee's performance across domains of intellectual functioning

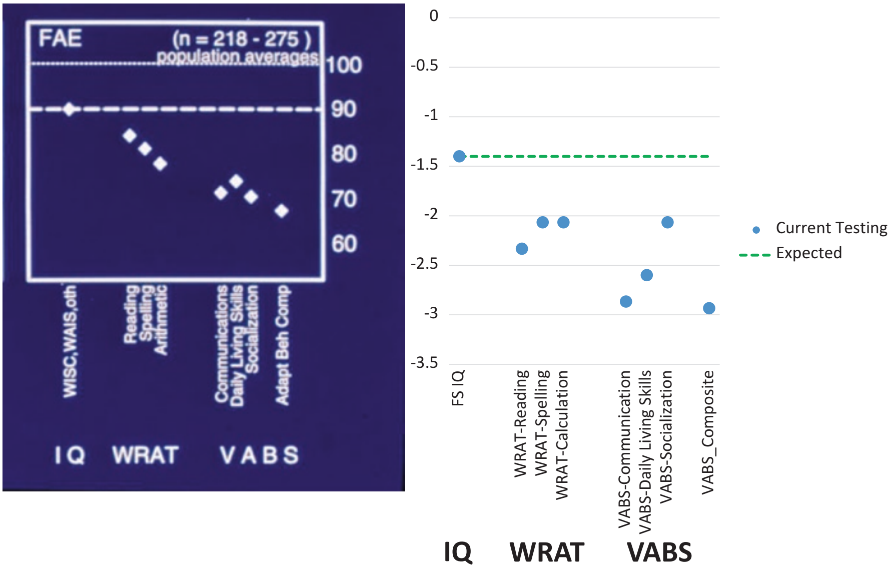

Fig. 5.3 Downward sloping test results (IQ, achievement, adaptive) in an evaluee with a low-average IQ

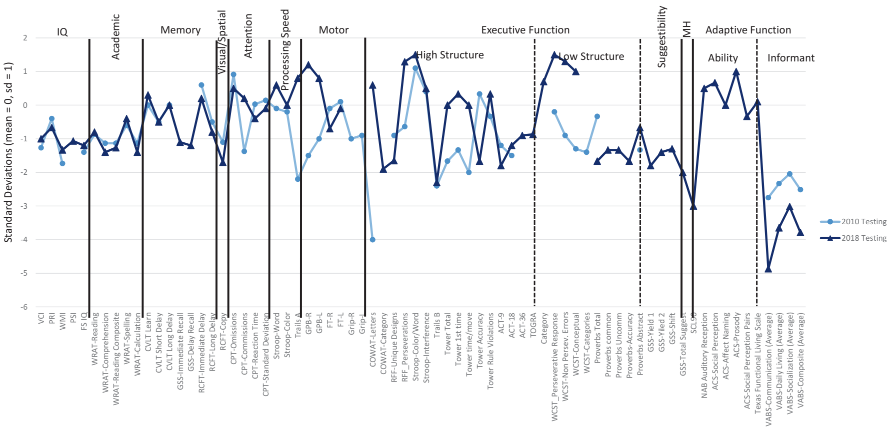

Fig. 5.4 Similarity (and change) in an evaluee's performance on many of the same tests over time

scale (e.g., z-score transformation of test results), triers of fact can appreciate visually whether evaluee test performance reflects the variability typically seen in FASD, immediately detect which functional domains are significantly impacted, and determine whether an evaluee's test performance matches patterns found in FASD research (e.g., downward slope from IQ to academics to adaptive functioning). In other words, a picture is worth a thousand words when it comes to explaining a complex subject.

5.6 Conclusion

This chapter has described how comprehensive neuropsychological evaluation is a vital first step in the adult FASD diagnostic process. Importantly, psychometric testing can identify if an evaluee's current pattern of cognitive functioning not only is consistent with diagnostic guidelines for FASD but also is consistent with characteristic empirical patterns. In diagnostic multidisciplinary assessments, test information is combined with information from other specialists (e.g., evidence of prenatal exposure to alcohol; documentation of a lifelong history of cognitive, behavioral and adaptive difficulties; evaluation of facial and other physical features; neuroimaging) to reach diagnostic conclusions. Patterns of cognitive strengths and weaknesses shed light on an evaluee's day-to-day functioning, explaining how brain functioning has affected behavior. Importantly, illustrating an evaluee's current neuropsychological functioning in graphic form to visually show its relation to underlying neurological damage caused by prenatal alcohol exposure provides functional capacity information that is directly relevant to case data such as alleged offense conduct. Documenting and describing this linkage or "nexus" during testimony can assist judges and juries in understanding offense conduct in a broader perspective, potentially assisting triers of fact in making decisions.

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