Neuropsychological Characteristics of

Information for prevention, prediction, and intervention efforts

The well-being of pediatric patients is not limited solely to physiological vitality. Mental health and the maintenance of healthy adjustment within an environmental context, including adaptive and behavioral functioning, are pivotal aspects of care for contemporary pediatricians. Invariably, pediatricians are faced with the challenge of assisting patients and their families in coping with behavioral difficulties throughout childhood and adolescence. As an unfortunate eventuate of such behaviors, pediatricians must frequently confront serious difficulties posed by juvenile delinquency (JD) in their patients, such as criminal and antisocial conduct, and are often responsible for assisting with recommendations to alleviate the havoc that these behaviors create in the lives of patients and their families.

The ramifications of JD pose potentially harmful and direct implications for both individual patients and for society. Thus, predictive, preventive, diagnostic, and interventional information related to serious behavioral disturbance, which is considered a risk factor for JD, is of great interest in the field of pediatrics.

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Pediatricians, along with other medical specialists, increasingly are using information gleaned from neuropsychological evaluation to assist with the complex aspects of care for patients with serious behavioral disturbances. Clinical neuropsychologists are specialists in the discipline of clinical psychology who focus on brain-behavior relationships.

The 2001 National Academy of Neuropsychology definition of a clinical neuropsychologist includes the following statements:

A clinical neuropsychologist is a professional within the field of psychology with special expertise in the applied science of brain-behavior relationships. Clinical neuropsychologists use this knowledge in the assessment, diagnosis, treatment, and/or rehabilitation of patients across the lifespan with neurological, medical, neurodevelopmental and psychiatric conditions, as well as other cognitive and learning disorders. The clinical neuropsychologist uses psychological, neurological, cognitive, behavioral, and physiological principles, techniques and tests to evaluate patients' neurocognitive, behavioral, and emotional strengths and weaknesses and their relationship to normal and abnormal central nervous system functioning. The clinical neuropsychologist uses this information and information provided by other medical/healthcare providers to identify and diagnose neurobehavioral disorders, and plan and implement intervention strategies.

In a neuropsychological evaluation, a patient's brain-behavior functioning is assessed within the perspective of an individual and idiosyncratic context, as well as by comparison to group (normative and nonnormative) data on neuropsychological functions. Understanding the neuropsychological profiles of children with behavioral disturbances who are likely to develop patterns of JD or other serious behavioral patterns, such as conduct disorder and oppositional defiant disorder, may allow pediatricians an opportunity to identify patients who display neuropsychological correlates that place them at risk. Furthermore, information from neuropsychological assessment can elucidate clinical information useful for developing appropriate intervention techniques to help in the remediation and reduction of aggressive, destructive, deceitful, and rebellious behavior patterns.

This article provides information on the utility of clinical neuropsychological evaluation to pediatricians' clinical practices as it relates to problematic patterns of behavior such as JD. This information is presented within the context of a review of current evidence-based knowledge in neuropsychology that is of importance when dealing with JD in clinical practice.

THE NEUROPSYCHOLOGICAL PERSPECTIVE ON JUVENILE DELINQUENCY

According to the revised version of the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, behavioral disturbance in children typically falls under the diagnoses of conduct disorder or oppositional defiant disorder. In the body of neuropsychological research, these broader classifications of common behavioral disturbances, in addition to the specific legal designation of JD, have been studied frequently.

An important consideration for appreciating the ecological validity of neuropsychological research findings is that JD is more prevalent than conduct disorder and oppositional defiant disorder. This prevalence may be due, at least in part, to the ease with which criteria for JD are met, relative to conduct disorder and oppositional defiant disorder. One single act may meet criteria for legal designation of JD, whereas extensive diagnostic investigation and the meeting of specific diagnostic criteria are necessary for a diagnosis of conduct disorder or oppositional defiant disorder. Furthermore, there is considerable overlap in shared behaviors between JD, conduct disorder, and oppositional defiant disorder, such that neuropsychological research in any one of these areas may be relevant to the other areas.

The association between delinquency and neuropsychological impairment is not new and has been repeatedly supported in the literature. A recent review of the relevant research by Teichner et al. suggests as many as 60% to 80% of delinquent adolescents have some type of inefficiency in neuropsychological processing. Therefore, physicians should be aware of findings from neuropsychological assessment that may be of assistance to identifying those patients at risk for further more serious behavioral disturbances, such as JD.

Information from a comprehensive neuropsychological evaluation involves exploring the effects of multiple factors (eg, genetic anomalies, teratogen exposure, brain injury, prenatal and perinatal complications) that are suspected to contribute to the expression of measured neuropsychological deficits. Some of these deficits are known to promote behavioral disturbance. It is the interaction between identified neuropsychological deficiencies and factors in the child's environment that promote JD.

NEUROPSYCHOLOGICAL CHARACTERISTICS RELATED TO JUVENILE DELINQUENCY

A wide range of neuropsychological functions have been studied in groups of children with JD, as well as other behavioral classifications such as conduct disorder and oppositional defiant disorder. These include, but are not limited to, impulsivity, cognitive flexibility, attention, verbal abilities, visuospatial abilities, and working memory. The body of research is relatively new in some of these
areas, whereas it is quite extensively developed in others. Neuropsychological research efforts have begun to consistently uncover specific patterns of behavioral functioning related to distinct neuropsychological profiles. Knowledge of the precise nature of the cognitive functions frequently found deficient in behavioral disorders can be useful for clinical diagnostic and intervention efforts.

The relation between intelligence (as estimated by IQ) and JD has been well documented in the literature and reflects a negative correlation wherein IQ decreases as incidence of delinquency rises. The significance of this relation has been strongly debated, with suggestions that factors such as socioeconomic status may serve as mediating variables that lead to both behavioral disturbance and lower IQ scores. For example, standardized IQ testing may be biased against certain populations. This issue is of particular interest to pediatricians who review results of neuropsychological assessment, and it has been clarified in recent research. Research investigations including the work of Lynam et al. have ruled out factors such as race, socioeconomic status, low test motivation, and risky lifestyle as accounting for the explanation of the relation, thus supporting the presence of a robust relationship between low IQ and delinquency.

When interpreting results of neuropsychological testing, pediatricians also should understand that any given low IQ score can be the result of weaknesses across a number of different neuropsychological areas of deficit. When a pediatrician has opportunity to examine IQ scores, the first step is to examine the two main scores that primarily compose most overall intelligence scores. These include, in the case of the gold standard Wechsler intelligence scales, Verbal IQ (VIQ) and Performance IQ (PIQ). Neuropsychological research findings consistently have shown VIQ to be less than PIQ for JD groups, typically to a magnitude of 8 to 15 IQ points.

It has long been proposed, on a theoretical and conceptual level, that specific verbal deficits pose a risk for behavioral disturbances such as conduct disorder and antisocial behavior problems. Research findings indicate that this logic does not hold true for all patterns of verbal deficit. This may be exemplified by research investigations that have measured the psychosocial functioning of groups of children with phonological processing-based learning disabilities of different ages. Findings indicate the majority of these children display relatively normal psychosocial and behavioral functioning with no appreciable disturbance of psychosocial functioning or behavior.

For the pediatrician, interpretation of the correlate of verbal deficits as an indicator of risk for JD in a patient may be somewhat complex. Evidence elucidating precise verbal and language deficiencies and their relation to behavioral problems has been growing. Findings indicate verbal deficits characterized by poor verbal reasoning and complex verbal learning disabilities are most implicated in JD.

Cluster analytic studies involving complex multivariate statistics designed to identify subgroups of children with verbal and language deficits suggest a profile approach is helpful in identifying children at risk for delinquent behavior problems. Research has suggested a profile of verbal deficits accompanied by executive neuropsychological deficits may have a negative effect on behavioral outcome. Executive functions refer to higher-order neuropsychological capabilities that are required for problem solving and that are involved in future goal-oriented behavior. Executive functions have become the focus of much interest to clinicians and researchers because of their importance in daily behavioral functioning and the finding that many
childhood disorders have corresponding deficits in this area.

As discussed, recent studies designed specifically to delineate the relation between JD and executive-based language deficits indicate children with impulsive and aggressive behaviors are likely to have deficits with more complex, higher-order, verbal neuropsychological functions, as opposed to more basic phonological functions, and thus appear to characterize the sort of language deficits most likely to be related to increased risk for behavioral difficulties. These findings resolve inconsistencies concerning the relation of language disorders and JD and provide information to answer the question of whether identified language deficits are of the sort that would be likely to accompany JD.

Additional executive-functioning deficits related to problems with behavioral regulation have been identified in relation to the inefficiencies in verbal and language-based processing. Specifically, behavioral-regulation deficits have been found in groups with executive deficits of attention, cognitive flexibility, and working memory. Of particular interest is the theory that specific deficits of executive function consistently have been found to be related to frontal lobe system dysfunction. This theory appears to be gaining attention because of the relation of frontal system dysfunction to specific types of behavioral disorders that commonly are present in children and adolescents displaying delinquent behaviors.

Specifically, neuropsychological deficits that appear to be subserved by dysfunction in the frontal areas of the brain consistently have been implicated in violent-offender behavior patterns. Deficient levels of performance on behavioral inhibition tasks known to be related to frontal lobe functioning are specifically linked to antisocial behaviors beginning at an early age. A review of research investigations, pertaining to JD in particular, supports the finding that delinquent adolescents display neuropsychological deficits in skills involving concept formation, abstract reasoning, cognitive flexibility, planning abilities, attention and concentration, impulse inhibition, and goal formulation. A comprehensive neuropsychological evaluation will provide information as to a patient's abilities in these areas of executive functioning.

Although no single, exhaustive list of executive functions is agreed upon in the discipline of neuropsychology, many researchers agree that attentional deficits (eg, sustained attention, selective attention) represent executive dysfunction. Clearly, not all children with disorders of attention, such as attention-deficit/hyperactivity disorder (ADHD), display or are even at significant risk for JD. Research investigations have demonstrated a high comorbidity rate between ADHD and conduct disorder. The ability to identify the neuropsychological features that distinguish these disorders would be particularly helpful for identifying target areas of intervention. Pediatricians would be able to work on remediating those areas that pose specific risk for conduct disorder and for later, more serious antisocial and other behavior problems.

Neuropsychological research provides important information for understanding this distinction. When examining the neuropsychological characteristics of children with ADHD and conduct disorder, it has been consistently discovered that children in both of these diagnostic classifications display deficits in attention. It is not uncommon to be faced with the scenario of a young child who is displaying inattentive and hyperactive characteristics to be brought to the attention of the pediatrician through complaints of behavioral disturbances by parents and teachers.

Recent research efforts have examined the presence of attentional and other executive deficits as a means for identifying neuropsychological characteristics that would assist with identifying those children with attentional deficiencies who may be at risk for behavioral problems. Findings from such studies have indicated it is the presence of additional executive deficits (eg, organization of complex material, planning, strategy generation) that serves to differentiate between children with only attentional disorders and those with comorbid behavioral disturbance.
Furthermore, the executive deficits found to be strongly related to conduct disorder were identified with tests that could be administered reliably to children as young as 10. Thus, the implications of these findings are such that identifying additional executive deficiencies through neuropsychological evaluation in a child who is showing attentional difficulties and behavioral problems may assist pediatricians in clinical practice with appropriate preventive efforts and specialized intervention at an early age. Other studies using different neuropsychological tests were able to differentiate between ADHD and behavioral disorders on the basis of the identification of patterns of executive dysfunction.  

Exploration of such patterns through neuropsychological assessment may aid the pediatrician in clinical decisions regarding the risk of JD. These findings are also of particular importance in legal venues. Thus, although it is well known that both ADHD and conduct disorder may relate to JD, the presence of neuropsychological characteristics that identify children with both attentional deficiencies and conduct disorder may assist with professional analysis of likelihood of future delinquent and law-breaking behavior.

Trends in neuropsychological research related to ADHD and conduct disorder also involve attempting to follow children who meet criteria for ADHD at younger ages (eg, ages 5 to 6) to examine whether neuropsychological characteristics at these early ages serve to predict later comorbid oppositional defiant disorder or conduct disorder. Although these studies are few in number and are in the early stages of development, preliminary results indicate neuropsychological measures are sensitive to early cognitive markers for the presence of ADHD with and without comorbid oppositional defiant disorder or conduct disorder. Future development of this body of research ideally will provide pediatricians means for predicting future differential outcome for children with attentional difficulties at a very young age.

Research on executive functions is also in the process of exploring other risk factors for JD that may be of interest to pediatricians. Clinical neuropsychologists should remain apprised of these findings because of their importance in evaluation and because some contradict long-held beliefs about the development of behavioral difficulties. For example, impulsivity has been suspected as related to displays of aggression. However, current neuropsychological research investigations have found problems with social-information processing (as identified through neuropsychological testing) may play a more critical role in the eventuality of aggressive behaviors.

A review of neuropsychological research findings relevant for clinical evaluation of behavioral problems also indicates the relationship between personality characteristics and neuropsychological functioning is an area of active investigation. Recent findings with adult populations suggest underdevelopment of specific personality traits is associated with neuropsychological deficits. Further research in the area of developing personality characteristics in children as related to neuropsychological functioning is needed.

NEUROPSYCHOLOGICAL CHARACTERISTICS AND ENVIRONMENTAL CONTEXT

Well-designed neuropsychological research controls for the confounding effects of environmental deprivation. However, in clinical practice, it is always important to consider the contribution of environmental variables to behavioral difficulties. In addition, pediatricians are well aware that the earliest developmental difficulties displayed by a child, such as abnormal orientation, responsiveness, and other reaction abilities, may affect a child's influence on the environment (eg, in the context of the parent-child relationship). Neuropsychological compromise does not act in isolation of environmental stressors or emotional state. To understand the relationship between neuropsychological deficits and the eventual expression of delinquent behavior, one must consider the child or adolescent within the context of his or her environmental system. Neuropsychological research has been conducted to examine the interaction of environmental variables with neuropsychological deficits and the effect this relationship may have on behaviors. Despite research efforts, however, potential interactions are easily overlooked and poorly understood. Children who display inherent risk through specific neuropsychological deficits and have coexisting environmental risk factors have been found to experience interaction effects leading to an early onset of delinquent behavior. This is important from a predictive standpoint because the persistence of delinquent behavior from childhood into adolescence is more likely when behavioral disturbance is exhibited early, especially in the form of aggression.

However, researchers suggest delinquent behavior may be exacerbated and diminished by certain environmental deprivation factors that can modulate predisposed biological tendencies and other psychosocial risk factors. Awareness of the effect of environmental deprivation factors can lead to the initiation and development of effective intervention regimes aimed at reducing the frequency of undesirable behavior. Long-standing theoretical models are being tested in this regard. Results consistently have shown that disadvantaged environment (eg, low socioeconomic status) and neuropsychological risk interact specifically to produce early-onset behavioral offending. Further research in this area will,
without doubt, prove very useful for pediatricians as they follow patients with neuropsychological vulnerabilities in changing environments over time.

SUMMARY

Knowledge of the neuropsychological characteristics related to JD and other behavioral disturbances in childhood is an important aspect of pediatric care. Referral of patients with developing behavioral problems for neuropsychological evaluation may assist pediatricians with identifying neuropsychological risk factors for JD, clarifying differential diagnostic questions, providing information for the nature of intervention efforts, and providing useful predictive tools for long-term planning and outcome. Thus, referrals for neuropsychological evaluation should not occur solely within the context of a patient with known central nervous system compromise. Neuropsychological results may be of benefit with disorders wherein the precise brain-behavior relationship is unclear, such as with JD. Once a child’s neuropsychological characteristics are known and evaluated from a behavioral risk standpoint, pediatricians will have information that is pivotal to asserting recommendations for modifications to the home and school environments, as well as for direct intervention and treatment.

The direction of future neuropsychological research includes the early identification of children and adolescents with potential behavioral disturbance. Accurate early differential diagnosis and knowledge of neuropsychological risk factors help to achieve this goal. Neuropsychological research and knowledge assist with understanding the complexities of interactions between environmental vulnerabilities and neuropsychological risk factors, and can provide useful predictive and preventative information for pediatricians.

REFERENCES