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January 2006**

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An Issue Devoted To Pediatric Neuropsychology

President's Message

In his President's message last year, now Past President Bob Ivnik referred to a "bully pulpit" in which the Division's President gets to advocate his or her agenda for the organization. Following his lead, though not considering myself a "bully", I am going to get on a soapbox for a little bit and advocate for what I consider to be an important activity in which all neuropsychologists should engage: advocacy. Advocacy is "the act of pleading or arguing in favor of something, such as a cause, idea, or policy; active support." Every day of the week, at local, state, and federal levels, issues are considered that affect the science and practice of clinical neuropsychology. Such issues include proposed regulations on practice, bills affecting public health and welfare, proposed funding for psychology education, and appropriations for federal support of science. I think it's true that psychologists as a species generally tend to be more poorly-organized and more passive when it comes to political or professional activism than, say, their colleagues in medicine or rehabilitation. However, I think that these times call for a renewed commitment on the part of all neuropsychologists to become vocal advocates for issues that affect the Division 40 membership family.

Why do many neuropsychologists suffer from "advocoagnosia"? Many feel powerless to effect change, feel uncomfortable engaging in politics or policy making, don't know what to say, who to call, how to have an impact. Very few of us have received any sort of systematic training in advocacy. At times, we seem to display the professional equivalent of the "bystander effect", seemingly content to have others intervene when grassroots support is requested. I would argue that we haven't been as effective as we can be because of these factors. Ask yourself, "how familiar are my administrators, my legislators, my community, with what clinical neuropsychologists have to offer?", and you'll see what I mean.

Cynics will say that we pay others to advocate or lobby for us through our APA dues and special assessments. Still others will say that nothing really substantive has come of advocacy efforts on behalf of neuropsychologists. Nothing could be further from the truth. The recent changes to the CPT code and the recognition of professional

In This Issue

Clinical Corner

Back issues of the Division 40 Newsletter are now available on line at the Division 40 Archives
The URL address is:
http://www.div40.org/newsletter.html

From The Editor

I am very pleased with this exciting issue of *Newsletter 40,* and hope you enjoy reading it. It is an issue dedicated to Pediatric Neuropsychology and contains a wealth of information communicated through both research articles and clinical reports. Also included in this issue is a very informative summary piece by Ida Sue Baron, PhD, as well as a news item by Bonny Forrest, PhD and Allan Mirsky, PhD, the latter of which is a perfect example of the role of advocacy, as encouraged by the current President of Division 40 in the President's message. Our children are our future and I sincerely hope that this issue of Newsletter 40 helps improve our ability to care for our children in this rapidly growing and changing field.   I would like to thank all who have taken the time to contribute to this issue.   We hope you enjoy this issue of Newsletter 40 and look forward to seeing you at INS!

Nancy D. Chiaravalloti, PhD
Editor

Advances In Neuropsychological Evaluation Of The Child

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Pediatric neuropsychology steadily progresses to encompass practice and research roles with broad applicability. Pediatric neuropsychologists have expanded their interests and scope into diverse clinical, scientific, educational, academic, and corporate arenas. Aspirational standards for education and training of the neuropsychological specialist (Hannay et al., 1998) are beginning to be effected and pre- and post-doctoral training opportunities operate consistent with models and standards for responsible and ethical practice (Boake, Yeates, & Donders, 2002) (Bowers, Ricker, Regan, Malina, & Boake, 2002).

These accomplishments reflect an evolving, forward maturational trajectory for pediatric neuropsychology practice and research that is central for those interested in brain-behavior relationships in infancy, childhood, and adolescence. Relevant developments are leading to ever more comprehensive, responsible, and efficacious pediatric neuropsychological practice (Baron, in press). Among these steps forward, in addition to traditional neurology and neurosurgery referrals current practice more often includes children with widely disparate conditions and diseases who are referred from medical specialties that previously were underserved. Appropriate emphases are increasingly placed on the importance of developmental models and theories to guide practice and empirical research. There is greater understanding and recognition that the range of acceptable function is wide, i.e., that one must firmly keep normal variation in mind in order to best understand any deviations or divergences from the expected course remains central to evaluation of brain-behavior maturation. Test development and application is constantly being refined and modernized in line with empiric research findings, with emphases placed on the importance of age, gender, ethnicity/race, psychosocial factors, and linkage to outcome measures for justification. Along with these steps forward, there is vigorous and healthy questioning of the expansive role of tests and measurement in specific situations and for specific childhood populations. While it is well ingrained that our tools need to possess good reliability, validity, and statistical power, measurement parameters are widening as the search for behavioral measures that best capture critical behaviors continues. One result is that a child's ability to reason strategically may be formally analyzed in novel but repeatable and standardized ways. Furthermore, as the search continues for more valid means to demarcate relevant neurocognitive maturational steps some old myths are finally being discarded.

Informed prognostic opinions that may be cautiously offered primarily on the basis of objective data nonetheless require reliance on subjective clinical judgment and skill. The recent literature reveals greater application of experimental procedures borrowed from the literature of colleagues in allied health, psychology and neuroscience fields, techniques and neuroradiological advances that stimulate new ways to investigate brain-behavior relationships and relate behavior to neuropathology and normal developmental stages. Such cross-discipline integration is especially important in the evaluation of children, especially very young children. Also moving forward, cognitive rehabilitation models are applied and critically evaluated for children with greater frequency and across a spectrum of disorders. Added importance is placed on attention to lifespan considerations, psychosocial factors, neurobiological variables, and environmental determinants. Overall, a dynamic and healthy pattern of growth and development characterizes the course of pediatric neuropsychology over recent decades.

The articles in this newsletter exemplify these steps forward. The papers range widely in topic area, but our colleagues highlight the need for societal responsibility for the individual who may be at neuropsychological risk when appropriate regulatory controls fail to offer sufficient protection. The assembled articles further attest to the importance of discriminating key component neuropsychological

subdomains (or microdomains) that typify behavior and avoid overused broad or overlapping definitions that do not sufficiently identify the etiological neuropsychological factors that may have critically important implications for targeted treatment options. Separate consideration by maturational level is also emphasized as it becomes more routine to consider developmental level in sophisticated ways and to acknowledge that there is a range of normal functioning that nonetheless contains some functions that are exceptionally strong as well as some abilities that remain relative weaknesses, and that individual variation has to be kept foremost in mind before ascribing labels of dysfunction or impairment. In articles that follow, broadly defined conditions are considered concurrent with our extensive and ever-increasing tangible knowledge base. Case reports are also included, re-emphasizing that we must not lose sight of the individual child or the benefits of parsing incisive features that may be illuminating but whose importance is easily overlooked when the reliance is primarily on data obtained from the experimental study of well-defined clinical or experimental groups.

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Association for Neuropsychology Students in Training (ANST) Update
Glen Getz, Ph.D. (ANST Chair) and Deborah Weber, Ph.D. (ANST Chair-Elect)

ANST is the organization within American Psychological Association Division 40 that serves the needs of neuropsychology students and trainees at the post-doctoral level. As a reminder, if you are a student affiliate of Division 40, you are automatically a member of ANST. In order to sign onto the listserv of ANST, send an email to LISTSERV@LISTS.APA.ORG and in the body of your message (not the subject line), type: SUBSCRIBE DIV40 ANST <your name> (e.g., SUBSCRIBE DIV40ANST Glen Getz). While the primary audience and discussion of the listserv involves student related issues in areas of practice, training and research, this listserv includes regular contributions from professional neuropsychologists. Therefore, all members of Division 40 are encouraged to sign up and participate.

In an attempt to meet the needs of students, ANST continues to work closely with the Education Advisory Committee of Division 40. ANST has recently been included as a voting member on the Education Advisory Committee and continues to represent students at the Division 40 Executive Committee meetings at APA and INS. We have recently started an initiative to increase the role of ANST by helping to develop student focused programs at national conferences, such as APA and INS. ANST has also been active in providing instructional activities at recent conferences as well as organizing social groups in an attempt to provide networking opportunities. We encourage students to attend ANST-sponsored convention programs and frequent our website (http://www.phhp.ufl.edu/anst/) for updates on these and other activities. Other educational resources continue to be offered at our website as well.

Finally, in the upcoming year, ANST plans on increasing our utilization of local ANST Chapters. Therefore, we continue to recruit for local Chapter student representatives and faculty members to facilitate Chapters. We also encourage students to

Neuropsychological Profiles of Disruptive Preschoolers

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Since the 1970's, a variety of models have been proposed identifying various "core" cognitive deficits in children with Attention-Deficit/Hyperactivity Disorder (ADHD), based on the suspicion that deficient neuropsychological functioning underlies the heterogeneous array of behavioral difficulties associated with the disorder. The executive dysfunction hypothesis, first promulgated in the mid to late 1980's has largely predominated contemporary thinking about the disorder. Although several variants exist, models of executive dysfunction have generally stipulated that individuals with ADHD experience deficits in higher-order cognitive processes (e.g., planning, working memory, and set-shifting) believed to be subserved by reciprocal neural networks within the prefrontal cortex. In an effort to promote a unified working model, Barkley (1997) suggested that ADHD might best be considered a disorder of inhibitory control that gives rise to a cascade of impairments in a number of secondary executive function (EF) domains.

However, despite an abundance of reports of significant group differences between individuals with ADHD and controls on commonly used standardized EF measures (e.g., Barkley, Grodzinsky, & DuPaul, 1992; Tripp, Ryan, & Peace, 2002), recent reviews and meta-analyses (Nigg et al., 2005; Wilcutt et al., 2005) have suggested that EF deficiencies do not account for most of the variance in ADHD symptoms, discounting the clinical utility of such measures in diagnostic assessment. In their meta-analytic review of 83 studies examining the discriminative utility of EF tasks, Wilcutt et al. (2005) found that, while measures of response inhibition, sustained attention, working memory, and planning differentiated many children with ADHD from matched controls, such deficits were neither necessary nor sufficient to account for ADHD and contributed limited variance. Furthermore, using a different methodological strategy, Nigg and colleagues (2005) found that only a small fraction of children diagnosed with ADHD performed within the "deficient" range on putative EF measures. Thus, while EF deficits are present in a proportion of children with ADHD, many perform within the normal range on standardized measures of EF.

Further obscuring the clarity of this body of research are psychometric issues, which have precluded investigators from arriving at a consensus regarding the integrity of EF models in ADHD. Perhaps most salient among these is the fact that many tasks employed to assess domains of executive functioning have neglected to control for other basic level functions subsumed by the executive function tasks (Doyle et al., 2005; van Mourik, Oosterlaan, & Sergeant et al., 2005).

Although studies of school age children are replete with investigations into the neuropsychological underpinnings of ADHD, the fact that: (i) the onset of ADHD symptoms most frequently occurs during the preschool period (Wilens et al., 2002), and (ii) this period is characterized by the rapid EF development, speak to the importance of examining if disruptive preschoolers exhibit impairments in discrete EF domains and if so, whether such deficits coincide with the emergence of ADHD symptoms.

Two recent studies by our research group (Berwid et al., 2005; Marks et al., 2005) sought to systematically address these issues in a non-referred population of disruptive preschool-aged children. In both instances, a series of tasks were created to examine discrete executive function domains: inhibitory control; perceptual and motor inhibition; sustained attention; non-verbal working memory; and memory for relative time. For all measures, paired control conditions were used to distill out the function(s) of interest and to rule out possible deficiencies in rudimentary skills (e.g., visual perception) required by the higher-

order experimental (i.e., executive function) condition. As has been suggested by other investigators (e.g., Sergeant, Geurts, & Oosterlaan, 2002) evidence of a specific deficit in executive functioning was predicated on the presence of a Group x Condition interaction, with at risk preschoolers performing differentially worse on the experimental vs. control condition relative to comparison controls.

Berwid et al. (2005) used a combined continuous performance (CPT) and go/no-go (GNG) task, and the Day-Night Stroop Task (Gerstadt, Hong, & Diamond, 1994) to measure sustained attention and inhibitory control in children between 3.5 and 7 years of age. Participants were separated into groups that were either 'high risk' or 'low risk' for ADHD according to parent and teacher ratings of the 18 DSM-IV symptoms of ADHD. Both the CPT and Day-Night Stroop task yielded indications of developmental sensitivity in this age range, as evidenced by significant Age x Condition interactions. However, children at high risk for ADHD performed more poorly on both control and EF conditions of these two tasks and failed to show evidence of specific deficits in the EF domains measured by these tasks.

In a similar vein, Marks et al. (2005) found that, while group differences were evident on several neuropsychological indices, the weaker performance of high risk participants cut across control *and* experimental task conditions. As such, no deficits could be attributed to the specific functions targeted by the tasks after accounting for non-executive abilities. Moreover, performance on executive measures was not related to objective indices of activity level or behavioral ratings of ADHD symptoms.

One possible explanation for the absence of executive function disparities is that the skills in question may be insufficiently developed to have discriminative utility in preschool children, and that such discrepancies may be become more evident with age. Yet, the apparent schism between executive function development and the presence of ADHD symptoms suggests that alternative models may be required to account for the emergence of early externalizing behaviors. One such model

considers ADHD to be a disorder of state dysregulation in which abnormalities in certain energetic pools (effort, activation, and/or arousal) compromise response inhibition, and potentially give rise to a nonspecific cluster of deficits (Sanders 1983; Sergeant 2000). Alternatively, ADHD behaviors have been conceptualized as reflecting either the inability to tolerate extended periods of delay prior to receiving a reward (Sonuga-Barke et al, 1992), or the presence of a relatively shortened reward gradient (Sagvolden et al., 1998). Finally, it has been posited that ADHD is characterized by deficiencies in the ability to 1) invest and maintain effort, 2) control behavior, 3) regulate arousal, and 4) resist the inclination to pursue immediate reinforcement (Douglas & Parry, 1983).

Yet, while theoretical models are likely to be of heuristic benefit and have the potential to inform clinical assessment and intervention, several issues need to be reconciled in future work with disruptive preschool children. First, the significant motor activity of at risk preschoolers may hinder efforts to acquire an accurate read on emergent executive function skills. In particular, behavioral dyscontrol may preclude children from demonstrating competencies that have, in fact, developed. In addition, investigators need to be mindful of the "tug of war" with regard to the granularity of skills being measured. Historically, many of the constructs under investigation, and the tasks used to assess them, have been multi-faceted, requiring numerous skills for successful performance. Although efforts to isolate discrete processes can potentially yield valuable scientific data, doing so may obscure group differences and compromise ecological validity. Importantly, a critical avenue of exploration, moving forward, will be to conduct prospective longitudinal studies that track the extent to which the development of cognitive abilities parallels the developmental onset and desistence of externalizing behaviors.

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Correction:

Neural Plasticity and Rehabilitation: What Neuropsychologists Should Know appeared in the last issue of Newsletter*40* (Volume 23, Number 2). Two errors appeared in the authorship notations. The authorship should have read:
Robert B. Perna, Ph.D., Westside Neurorehabilitation Services ; Austin L. Errico, Ph.D Lakeview Neurorehabilitation Services ; Jenn Bubier, Westside Neurorehabilitation Services

We Need to Do More than Remove the Lead

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The Washington D. C. Water and Sewer Authority plans to replace more than 23,000 lead pipes by 2010 in an ambitious effort to eliminate the toxic metal from the city's water supply. The authority is moving at a pace faster than mandated by federal regulators to eliminate further lead exposure, and that is admirable. But the effects of past exposure and how to best treat those affected by it also needs to be assessed.

Even at low levels of exposure, lead can negatively affect intelligence, language, attention span and mathematical ability. Exposure, even at "permissible" levels, can lead to fatigue and muscle pain. Other effects can include changes to the kidneys and the central nervous system.

However, the effects of exposure to lead are difficult to measure. The most common test, used by the District, measures lead levels in the blood. However, lead in blood has a half-life of about 36 days, so a blood test measures only recent exposure. Many D.C. residents have been drinking water from lead pipes for years. Bone measurements of lead provide the best indicator of long-time exposure because the body stores lead primarily in calcified tissues, and the danger of bone testing is small, because it involves only a small dose of radiation. In addition to this form of testing, the District needs a plan for addressing the effects of lead exposure when it is combined with additional environmental factors. For example, children from low-income families are more likely to be exposed to other sources of lead, such as lead paint in their homes and at school. Poor nutrition also can exacerbate the effects of lead exposure. As a result, children at increased risk should be tested comprehensively and periodically. Standard academic testing does not necessarily detect the more subtle effects of exposure to lead. Therefore, children and adolescents in high-risk areas need individual evaluations of attention span and related abilities. The results of such testing would allow the development of individualized treatment strategies as needed.

Lead exposure has been tied to the increased likelihood of dropping out of school, increased delinquency rates and early mortality. High bone-lead levels also have been linked to antisocial behaviors such as bullying, vandalism, truancy and shoplifting. These consequences are severe enough that the District should develop an interagency plan to assess the damage done by lead exposure and then design treatments for those affected.

The D. C. Water and Sewer Authority should be congratulated for the aggressive approach it is taking to lead exposure by its quick replacement of pipes. Now, the city needs an equally aggressive approach to assessing and mitigating the problems that lead exposure has caused.

Neural Substrates of Inhibitory Control in Adolescents with Childhood ADHD

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Converging research has implicated impairments of frontostriatal brain regions and the inhibitory control functions they purportedly mediate in the pathophysiology of attention-deficit/hyperactivity disorder (ADHD). For decades, neuropsychological studies have noted the similarity in inhibitory deficits between individuals with ADHD and patients with frontal lobe lesions (Mattes, 1980; Pontius, 1973), and structural magnetic resonance imaging (MRI) studies of individuals with ADHD have fairly consistently reported reduced volumetric measures of the prefrontal cortex and other regions of the striatum (Castellanos, 2001; Seidman, Valera, & Makris, 2005). Functional MRI (fMRI) studies also report differences in frontostriatal activation between individuals with ADHD and controls while performing tasks designed to assess inhibitory control (Bush et al., 1999; Durston et al., 2003; Rubia et al., 1999; Schulz et al., 2004; Schulz et al., 2005b; Schulz, et al., 2005a; Vaidya et al., 1998). However, these latter findings have varied somewhat with regard to the precise brain regions involved and the direction of findings, and may vary as a function of the sample as well as the specific task used to assess inhibitory control. As such, the precise nature of the pathophysiology in ADHD as it relates to inhibitory control deficits has remained elusive.

One approach to further elucidating the neural substrates of ADHD is to focus on the developmental course of these neural differences and their relation to ADHD symptomatology across the life span. Symptoms of ADHD typically emerge during the preschool years (Campbell, 1995) and often persist into early adulthood (Barkley, 1990). Nevertheless, most children with ADHD experience a diminution of symptoms during late childhood and adolescence (Hill & Schoener, 1996; Biederman et al., 2000). Yet, little is known about the neural correlates and potential determinants of ADHD symptom course. Structural MRI findings (Castellanos et al., 2002) point to developmental changes in the nature of the frontostriatal abnormalities such that caudate nucleus volume reductions in ADHD are most prominent in late childhood and seem to normalize during adolescence, which coincides with the waning of hyperactive symptoms frequently seen in these patients (Biederman et al., 2000; Hill and Schoener, 1996). As such, investigation of adolescents who were diagnosed with ADHD during childhood, but who vary with regard to current diagnosis, may yield answers regarding the developmental course of neural abnormalities in ADHD.

Our group recently completed a set of studies which used fMRI to examine neural activation in a sample of youth who were diagnosed with ADHD during childhood, followed prospectively, and re-evaluated during adolescence (Schulz et al., 2004; Schulz et al., 2005b; Schulz et al., 2005a).   Because inhibitory control is a heterogeneous set of self-regulatory functions (Nigg, 2000), we used two different inhibitory control paradigms to capture distinct aspects of this multi-dimensional construct.

Ten male participants were initially screened using teacher ratings and diagnosed with ADHD via structured interview as part of a research protocol conducted between 1990 and 1994 when they were 7 – 11 years-old. At the time of the re-evaluation they ranged in age from 16 to 19 years (mean ± SD = 18.2 ±

1.3 years), and the time since the childhood evaluation ranged from 7.6 to 11.0 years (mean ± SD = 9.0 ± 1.2 years). All received a clinical re-assessment during adolescence that included structured interviews using the NIMH Diagnostic Interview Schedule for Children-Version IV (Shaffer, 1997), ratings of behavior, and intelligence testing. All of these participants continued to exhibit symptoms of inattention and hyperactivity-impulsivity at follow-up; however, only 5 demonstrated a sufficient number and severity of symptoms to meet diagnostic criteria for ADHD. Severity of ADHD symptoms was assessed with the Attention Problems factor of the Child Behavior Checklist (CBCL; (Achenbach, 1991) which was completed by parents (mean ± SD = 63.5 ± 11.0). Ten age- and IQ-matched male controls who never had ADHD were recruited from the communities of the patients. No patient had received medication for ADHD in the six months prior to follow-up, and no control had ever received such treatment.

All adolescents were scanned with fMRI while performing both a Go-No/Go task and the Perceptual and Motor Conflict Tasks (PMCT)(Nassauer & Halperin, 2003). Structural and functional MRI scans were acquired on the same 1.5 Tesla GE Horizon scanner (General Electric, Milwaukee, WI) modified with hardware for Echo Planar Imaging (EPI). Functional images were acquired by means of a multi-slice 2-dimensional EPI sequence depicting blood oxygenation level dependent (BOLD) contrast. Participants completed 3 runs of 200 seconds resulting in 100 time points each. Each functional image comprised a full brain volume of 14 horizontal slices at 2.5 mm separation and with 5 mm in plane resolution, acquired continuously over each run with a repetition time of 2000 ms. T1-weighted structural images were also acquired for each subject.

The Go/No-Go task was designed to measure the ability to inhibit prepotent responses to rare nontargets (NOGO trials) in the context of frequent targets (GO trials). Event-related analyses were conducted with general linear modeling (GLM) using the default SPM basis function, which consists of a synthetic hemodynamic response function composed of two gamma functions and its derivative. Response inhibition was tested by applying linear contrasts to the parameter estimates for the correct NOGO minus correct GO contrast.

Adolescents who had ADHD during childhood made significantly more commission errors on NOGO trials than controls (28.6% vs. 14.7%). FMRI results indicated that the inhibition of a prepotent tendency to respond produced markedly greater activation in those with childhood ADHD as compared to controls. Specifically, compared with adolescents who had no history of ADHD, adolescents who were diagnosed with ADHD during childhood exhibited *enhanced* neural responses during inhibition in ventrolateral prefrontal cortical areas that subserve response inhibition, as well as in anterior cingulate and frontopolar regions implicated in other executive functions. We hypothesize that this enhanced response is related to the increased effort required by these individuals to perform the task (Schulz et al., 2004).

Further analyses examined the relationship between task performance and the persistence versus remission of ADHD symptoms during adolescence (Schulz et al., 2005a). These analyses indicated parallel linear trends in performance on the go/no-go task and activation of ventrolateral prefrontal cortex, such that persisters made the most commission errors (33%) and showed the greatest activation, remitters made fewer commission errors (24%) and had lower activity, and activation was lowest in controls who made the fewest errors (13%). These preliminary results suggest that developmental changes in ADHD symptomatology are associated with functional changes in ventrolateral prefrontal cortex activity.

The PMCT (Nassauer & Halperin, 2003), which was developed and validated in our laboratory at Queens College, consists of six subtests that provide theoretically distinct measures of the ability to: a) inhibit response to irrelevant stimulus characteristics; b) inhibit prepotent motor responses; and c) integrate the two aforementioned inhibitory processes. The three inhibition conditions were compared to a control condition that did not involve conflict between stimulus characteristics and motor responses and did not require inhibition. General linear modeling (GLM) was conducted for the

functional scans from each subject by modeling experimental subsets as delayed box-car functions. The effects of the three inhibitory conditions (i.e., Stimulus Characteristic, Prepotent Motor Response, and Combined) were tested by applying linear contrasts to the parameter estimates for each condition.

In contrast to the Go/No-Go task, no group differences in performance were evident on measures of interference control and/or response competition. However, the ADHD group demonstrated significantly greater activation of left ventrolateral prefrontal cortex during interference control, as well as greater activation of left anterior cingulate cortex, right ventrolateral prefrontal cortex, and left basal ganglia during the dual task of interference control and response competition. Further, *the magnitude of the prefrontal and basal ganglia activation was significantly positively correlated with severity of ADHD during adolescence* (Schulz et al., 2005b).

These findings contribute to the growing body of evidence regarding the neural substrates of ADHD and place them within a developmental context. These data suggest that adolescents with a history of ADHD have a greater BOLD response in several frontostriatal regions and that frontal activation in response to inhibitory control is inversely related to severity of adolescent symptoms such that those with fewer ADHD symptoms appear more like controls. The greater and more diffuse frontostriatal activation in those with increased adolescent symptoms is reminiscent of immature brain function associated with poorer inhibitory control in healthy children relative to adults (Casey et al., 2002; Durston et al., 2002), and suggests greater cognitive effort to inhibit behavior as compared to less symptomatic patients as well as adolescent controls. As such, it is possible that the increased activation in adolescents with childhood ADHD may reflect greater effort to overcome or inhibit inappropriate behavioral responses. Finally, these data suggest that the extent to which symptoms of ADHD decline throughout adolescence and young adulthood may be related to developmental changes in frontostriatal brain regions involved in inhibitory control processes.

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consider possible involvement as a student leader at the national level within ANST. If you are interested in participating in ANST or have any questions, please contact us at ggetz@wpahs.org. We look forward from hearing from you on the listserv.

Clinical Corner

Cerebral Palsy: Recognizing Early Neurodevelopmental Factors That Influence Outcome in the School Age Child

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Introduction:

Cerebral palsy has long been viewed as a consequence of perinatal asphyxia, with associated complications, including motor and cognitive impairments. An overview of the literature addressing differential diagnostic considerations of cerebral palsy and perinatal asphyxia is presented below. A brief discussion of the stages of neurodevelopment is also provided to assist the neuropsychologist when providing an assessment of a young child diagnosed with cerebral palsy. Finally, using a single case example, the neurodevelopmental and neuropsychological outcomes of a patient diagnosed with perinatal asphyxia, is presented. The utility and predictive validity of developmental measures, such as the Bayley Scales of Infant Development-II and the Mullen Scales of Early Learning, is explored within the context of interpreting the test data.

Cerebral Palsy:

Cerebral palsy (CP) is a collective term that refers to a spectrum of clinical symptoms whose common thread is an insult or injury to the developing brain. Typically, the etiological factors which are impacted in the central nervous system (CNS) include disorders of movement and posture caused by a nonprogressive lesion in the brain. Traditional signs of CP are spasticity, movement disorders, ataxia, rigidity, and muscle weakness. The damage to the CNS can occur in any one of the following periods: in utero, during delivery, and during the first two years of life, with severity ranging from a mild motor impairment to the necessity of a wheelchair due to whole body involvement. In children, the periventricular regions of the brain are particularly sensitive during the perinatal period of development. Hence, the diagnosis of cerebral palsy is often accompanied by neuroimaging findings which may reveal neuropathological evidence for periventricular leukomalacia, hypoxic ischemic encephalopathy, and in more severe cases intraventricular hemorrhage. Several factors have been linked to the development of the disorder including multiple births, maternal infections, fetal anoxic events, and fetal infection.

The exact cause of CP in an individual child may be difficult to ascertain, although it was previously widely accepted that a majority of CP cases were caused by asphyxia. While an association between CP and asphyxia is observed, the relationship may not be as robust as once thought. For instance, in over 75% of CP cases a single cause cannot be deciphered. Furthermore, contrary to previous assumptions, only 8-10% of children diagnosed with CP were noted to have asphyxia and a majority of children who survive asphyxia do not develop CP (Pschirrer and Yeomans, 2000).

Additionally, the associations between the cognitive and motor deficits noted in cerebral palsy are poorly understood. It is highly likely that children with CP can present with severe cognitive deficits in the absence of any significant motor impairments. Nonetheless, theories have emerged that suggest that motility impairments, such as diplegia, which retard advancement through the psychomotor stages of development, can actually hinder cognitive development. Evidence supporting these theories is derived from observing children with significant motor deficits early in life appearing to have accelerated cognitive development later in childhood (Pirozzollo and Bonnefil, 1996).

In the past 20 years, there has been substantial longitudinal research documenting the effects of prematurity and low birth-weight on outcome in children. In fact, there has been an abundance of research generated from cohorts of children of extremely low birth weight (<1000 g.) versus a variety of gradations measuring low birth weight (<2500 g) (Taylor, H.G & Colleagues, 1994; Hack, et. al., 2005). The conclusions from multiple studies have supported the fact that adverse pregnancy outcomes decrease with increasing birth-weights. This has led many investigators to conclude that birth-weight is a significant determinant of postnatal developmental in the child diagnosed with cerebral palsy. There has been less research examining the effects of the full-term infant diagnosed with cerebral palsy and the implications for development over time.

Perinatal Asphyxia / Hypoxic-Ischemic Encephalopathy:

The most common insult to the developing central nervous system resulting in brain injury is asphyxia, which is defined as an "impairment of gas exchange that results in a decrease in oxygen in the blood and an excess of carbon dioxide that leads to acidosis…" (Unanue and Westcott, 2001, p. 15). Recent research has denoted that perinatal asphyxia is a factor in decreased cognitive and motor development, as well as being associated with neurological conditions, such as cerebral palsy (Maneru, Junque, Botet, Tallada, and Guardia, 2001).

Incidence rates of asphyxia are estimated to be between 2 and 9% for full term infants (Flavin, 2001; Unanue and Westcott, 2001), with the rates reaching upwards of 60% in preterm infants. Of those infants who sustain asphyxia, approximately 20-50% may die during the newborn period (Flavin, 2001); whereas approximately 20-30% asphyxiated infants will develop mental retardation, cerebral palsy, or seizure disorders (Unanue and Westcott, 2001). Approximately, 20% of the cases involving perinatal asphyxia are due to prenatal factors. Overall, neurologic prognosis is dependent upon the severity and duration of asphyxia (Volpe, 1995; as citied in Flavin, 2001).

Asphyxia is the most common underlying cause of hypoxic-ischemic encephalopathy (Unanue and Westcott, 2001), which occurs when there is a decreased level of oxygen in the blood, resulting in lowered levels of blood being supplied to various tissues and organs (Flavin, 2001). Additionally, the gestational age of the infant plays a large role in the lesion location associated with the insult (Unanue and Westcott, 2001), as hypoxic damage or necrosis (cell death) is distinct for full term and preterm infants (Flavin, 2001). In full-term infants, lesions are specific to the cerebral cortex, hippocampus, basal ganglia, thalamus, vascular border zones, and the middle cerebral artery, whereas lesions in the preterm infant include periventricular-intraventricular hemorrhage (PIVH) and periventricular leukomalacia (PVL) (Flavin 2001; Unanue and Westcott, 2001).

Stages in Neurodevelopment:

In pediatric neuropsychology, it is important to address the issues of development within the context of brain-behavior relationships (Baron, 2004). In normal development, the brain typically follows a general pattern, first beginning with the neural tube, with a gradual sequence of attaining the features of the adult brain (Kolb and Fantie, 1997). The development of the brain is segregated into 4 different stages: cell division, migration, proliferation, and pruning (Baron, Fennell, and Voeller, 1995; Spreen, Risser, and Edgell, 1995; Kolb and Fantie, 1997). Cortical development progresses from the inside to the outside, as such the neurons that make up Layer VI are formed first (Spreen, et al., 1995; Kolb and Fantie, 1997). Cell division results in the production of a variety of neurons, which will end up in the different cortical layers. The production of these neurons occurs at different points in development, depending on the layer when it is forming (Baron et al., 1995; Kolb and Fantie, 1997).

The final destination of neurons is largely determined through cellular migration (Spreen et al., 1995), which places neurons in a specific zone that serves a different function (Baron et al., 1995). The rate at which cells migrate depends on several

A Case of Prader-Willi Syndrome

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Prader-Willi Syndrome (PWS) is a genetic disorder with a prevalence of about one in 12 to 15,000. It affects both sexes equally and penetrates all races. PWS, first identified in 1956 (Prader, et al., 1956), is a disorder of chromosome 15. More than one gene is involved in PWS all of which are proximal to each other in a small area of the long arm of chromosome 15 in the area 15Q11-Q13. In all cases of this disorder, the diluted chromosome is always from the father, as the mother's genes in this area are turned off through a rare phenomenon known as genomic imprinting. The major characteristics of Prader-Willi Syndrome include hypotonia, hypogonadism, hyperphagia, cognitive impairment, and behavioral and mood disorders.

Among the major medical concerns of PWS is morbid obesity. Children and adults with this disorder have unremittingly voracious appetites. Consistent with that, they manifest poorly controlled food seeking behaviors and they have a strong propensity to gain weight at an accelerated rate (Baron, Fennell, & Voeller, 1995). In addition to morbid obesity, major clinical findings of this disorder include neonatal and infantile central hypotonia which improves with age, feeding problems during infancy with rapid and excessive weight gain between the years of one and six and distinctive facial features which include a narrow face, almond shaped eyes, and a small appearing mouth with a thin upper lip and turned down corners. Additionally, hypogonadism with genital hypoplasia with delayed or incomplete gonadal maturation, and delayed puberty signs after age 16 are part of the disorder. There is typically a global developmental delay before the age of six. Mild to moderate mental retardation or learning problems are identified in childhood.

Children with PWS present with numerous behavioral, medical, cognitive, and educational challenges. Characteristically, PWS children display behavioral problems including temper tantrums, violent outbursts, obsessive-compulsive behaviors, tendencies to be oppositional and argumentative, rigid, manipulative, possessive, and stubborn behaviors, and perseverating, stealing, and lying are all common. Sleep disturbances or sleep apnea is common as are speech articulation deficits, short stature, small hands and feet, and sometimes disregulation of temperature and decreased pain sensitivity.

Parents of children with PWS consult pediatric neuropsychologists for comprehensive evaluations to assist with behavioral and school difficulties. Not uncommonly, children with PWS present challenges to the educational system not only because of their cognitive and academic issues, but because of their behavioral issues as well. Educational planning and programming must take into account the unique behavioral characteristics of PWS children that often constitute difficulties in classroom management. Among these are the behavioral problems noted above including temper tantrums, obsessive compulsive behavior, unremitting food seeking and eating, moodiness, rigidity, and anti-social type features.

The Case of A.S.

The parents of a nearly 12-year-old, right handed, Caucasian female consulted the author for an assessment of her cognitive strengths and weaknesses in order to assist with educational planning and programming. At the time of the evaluation, AS was a special education student having just completed the fifth grade in a suburban elementary school. She was classified by the child study team as multiply-handicapped and was in a self-contained classroom. Two years prior to this examination, she was formally diagnosed with Prader-Willi Syndrome by a neurodevelopmental pediatrician. Prior to that, she had been diagnosed with ADHD and had been treated with Metadate. At the time of this evaluation, the patient was

considerably overweight for her age and had difficulty controlling her intake of food. In addition to 50 milligrams of Metadate per day, she took 150 milligrams of Topamax to help control her excessive appetite.

History revealed that the patient had been carried to a full term pregnancy and was delivered via a normal spontaneous vaginal delivery. She weighed eight pounds/four ounces at birth with Apgar scores in the low normal range. Her parents reported that all of her developmental milestones were delayed, e.g., she did not stand until 18 months and uttered her first words at 14 months. Early medical history was also positive for numerous ear infections as a toddler with a resultant decrement bilaterally in her hearing. When seen at the age of four by her pediatrician, it was observed that she had delays in speech and language, motor, and motor planning abilities, attention, and cognitive skills. These were determined by the pediatric examination but no formal psychological or neuropsychological testing was done.

A speech and language evaluation at that time was consistent with below average receptive and expressive language skills. Specific deficits were noted in expression and comprehension of complex language; deficits in immediate and delayed auditory recall, difficulty with comprehension, problem solving, and critical thinking.

At the time of the current examination, the patient had begun to exhibit symptoms consistent with OCD including repetitive picking of her nose and skin and ritualistic, repetitive, clapping of her hands.

On interview and observation, the patient was a girl who appeared to be about her stated age, though she was considerably heavier than most children her age. She seemed considerably less socially mature than the average 11-year-old, more like that of a 7-year old. She engaged in very little spontaneous speech during the examination though she did respond appropriately to questions asked. She displayed difficulty maintaining focus on numerous tasks in the examination and appeared repetitively distracted throughout. (Her usual dose of Medidate had been held). She continued to make rather socially inappropriate, if idiosyncratic behaviors

during the evaluation including picking her nose and repetitive picking at her skin. She exhibited a rather neutral mood with a constricted affect. Psychotic features were neither observed nor suspected.

Examination Results

The patient was administered the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV). She earned a Full Scale IQ of 62 that was at the first percentile and in the extremely low range (mild mental retardation). She showed a good deal of disparity among her various scores. She obtained a Verbal Comprehension Index of 98 at the 45th percentile but a Perceptual Reasoning Index of 57 which was below the first percentile. Her Working Memory Index was 65 at the first percentile and in processing speed she had a standard score of 50 which placed her below the .1 percentile.

She showed a relative strength in verbal abilities on the WISC with her highest score on Vocabulary (ss=11). She had scaled scores of nine on Similarities and Comprehension, and a scaled score of eight on Information.

Non-verbal Wechsler scores ranged from a high at the ninth percentile (PC) to below the first percentile (BD Standard Score = 2). Visuospatial abilities were extremely weak.

On tests of working memory, she scored between the second and first percentile (e.g., DS Standard Score = 2) and she had considerable difficulty on all tests assessing processing speed where her scores were all below the first percentile. Consistent with reports in the literature concerning the intellectual performance of PWS children, the patient's Full Scale IQ fell in the mildly mentally retarded range.

Tests of academic achievement resulted in a Woodcock-Johnson Reading score at the third percentile, a Math score below the third percentile, Written Language at the second percentile, and Academic Skills overall at the second percentile. Academic Fluency was impaired at the first percentile and Academic Applications were at the second percentile. Despite her average verbal intellectual abilities, the patient was performing more poorly than expected on tests of language and verbal achievement.

Wechsler Intelligence Scale for Children-IV

Scale / Subscale	Standard Score
Full Scale IQ	62
VCI	98
PRI	57
PSI	50
WMI	65
Similarities	9
Vocabulary	11
Comprehension	9
Information	8
Word Reasoning	6
Block Design	2
Picture Concepts	4
Matrix Reasoning	3
Picture Completion	6
Digit Span	4
Letter-Number Sequencing	4
Arithmetic	3
Coding	1
Symbol Search	1

She showed consistent difficulties with attention and concentration on various tests. These included Children's Trail Making where she could not complete Trail Making Part B. Similarly, on the Conners' Continuous Performance Test, Second Edition, her overall profile suggested that 88 times out of 100, her performance was consistent with a clinically significant attention problem.

Tests of language and paralinguistic abilities revealed a low average score on the Boston Naming Test for her age. Both letter and category fluency tests fell in the impaired range, however, and she showed labored writing and labored verbal expression generally. She showed poor automatic naming for colors and shapes where scores fell into the deficient range.

Upper extremity motor strength was assessed with the Finger Tapping Test where the patient scored within normal limits bilaterally suggesting intact cortical motor systems. But she performed well into the severely impaired range on the Grooved Pegboard Test assessing fine motor skills where her bilateral performance was greater than four standard deviations below the mean for her age and gender. This finding suggested dysfunction of subcortical motor systems bilaterally.

Tests of visual-motor integration and visuoperceptual skills all fell well into the impaired range. She was unable to draw any more than the simplest lines or circles on the Beery Developmental Test of Visual-Motor Integration where her performance was below the first percentile. She showed severe constructional dyspraxia in attempting to copy the Complex Figure as well (see below). She could not complete either the Benton Judgment of Line Orientation Test or the Arrows Test of the NEPSY as she became frustrated and angry during the testing because of her great struggles with the task. Other tests of perceptual skills including the Hooper Visual Organization Test and the Benton Facial Recognition Test, both of which fell in the significantly impaired range.
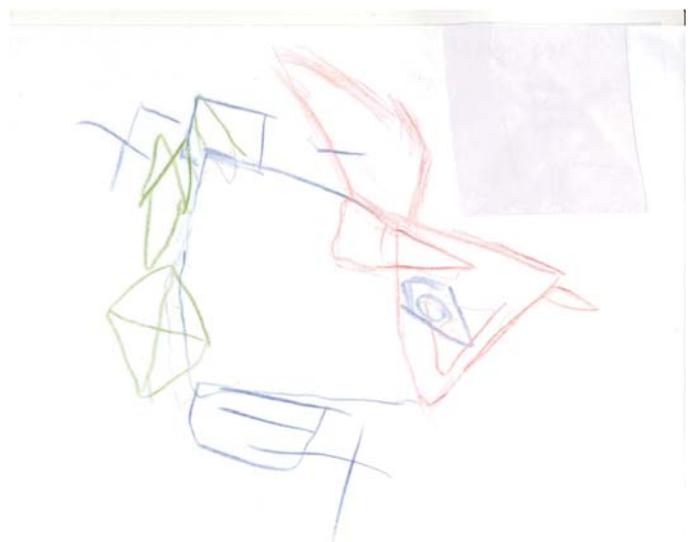

Figure. Rey Complex Figure (copy)

On tests of learning and memory, the patient displayed some of her best performances. On the Children's version of the CVLT, she had an overall T-score of 62 reflective of above average learning and immediate recall of word lists. She displayed an interesting, rather flat learning curve where on trial one of the test, she correctly recalled 10 of the 15 words but by trial five, she continued to remember only those original ten, unable to demonstrate progressive learning over time.

But despite the patient's relatively good performance on word list learning, she performed considerably worse on story recall tests. She scored at the 16th percentile on the immediate recall of two auditorally presented stories. After a delayed interval, her performance slipped further to below two standard deviations, placing it into the impaired range. She showed impaired delayed recall for semantic/prose material. This, too, is an interesting pattern in that semantic memory is often more robust than list learning. Rote memorization was easier for her than learning and remembering more complex integrated semantic verbal material.

She had universally impaired scores on all of the non-verbal visual memory tests where she scored below the first percentile. Her attempt at the memory trials of the Complex Figure also resulted in a performance in the impaired range greater than 2 ½ standard deviations below average.

Overall, the patient demonstrated variability of her memory system where rote verbal material was preserved but other forms of verbal and non-verbal memory fell into the impaired range.

In the area of executive functioning and abstract reasoning, she showed significant executive system dysfunction in many areas. She showed little success in inhibiting a response to read on the Stroop Test where her performance fell three standard deviations below average for her age. She also showed slow color naming and word reading consistent with her school-related difficulties in the verbal area, particularly in reading.

Verbal fluency also was impaired for both phonemes and categories indicating the presence of poor word retrieval and verbal initiation skills.

Tests of working memory were also found to be difficult for the patient where she had great difficulty holding on to small amounts of verbal material in the face of mild interference. Likewise, she had trouble on tests such as Trail Making Part B where alternating and dividing her attention were troublesome for her, as were a host of other tasks requiring simultaneous processing (multitasking).

Tests of reasoning in the verbal area, however, were average (Similarities) but she performed universally more poorly on any non-verbal reasoning tests such as Wechsler Block Design and Matrix Reasoning. She failed to grasp the essence of the Wisconsin Card Sorting Test where she made many perseverations, showed loss of set, and ultimately scored below the 1st percentile in terms of categories achieved.

Emotionally she was a very pleasant and delightful child. She was not particularly conversant but she did snack throughout the testing day as her parents brought her snacks to eat while she was working. At one point when she finished her snacks she displayed frustration and became slightly teary.

She showed evidence of repetitive behaviors in terms of ritualistic hand motions as well as socially inappropriate behaviors such as picking her nose and picking at her skin throughout the testing day, seemingly unaware of the inappropriateness of these behaviors.

Although not directly observed, her parents reported periods of significant anxiety and depression. Tantrum-like behavior was also reported by her parents particularly occurring when she is denied free access to food. Tantrum behavior was also reported at some point when she was asked to transition from one activity to another, again indicative of rigidity and "stickiness."

Discussion

Ultimately, this child presents many challenges for her parents and the educational system. She manifested unequivocal evidence of significant perceptual impairment on convergent measures assessing various aspects of visuospatial and visuoperceptual abilities. Consistent with that, left-hand fine motor skills were much more severely impaired than those with her dominant right hand. In a similar vein, visual memory functions were severely impaired, as well. These findings were

consistent with an impression of the presence of dysfunction of the non-dominant right hemisphere.

Similarly, the patient exhibited converging evidence of impaired executive functions likely to be attributable to frontal dysfunction bilaterally.

This patient presents many challenges to the educational system. Academically, her cognitive profile is challenging in that she exhibited relatively intact verbal skills juxtaposed against significantly impaired perceptual and visuospatial skills. The greater than two standard deviation difference noted on the Wechsler Scales with 41 point differential and a base rate of .2% was corroborated by other neuropsychological tests sensitive to the integrity of the dominant and non-dominant hemispheres, respectively. Unfortunately, neuroimaging was not available to shed further light on these findings particularly as to whether or not structural anomalies also accompanied these extant cognitive abnormalities.

Other challenges to the educational system of this patient and other Prader-Willi patients include their behavioral disorders. This patient presented with the typical pattern of compulsive eating that, if uncontrolled, is seriously deleterious to their health. Similarly, other evidence consistent with a developing OCD was noted in this patient as well as difficulties with emotional regulation and social/interpersonal skills.

Ultimately, it was deemed appropriate to recommend an out-of-school-district placement in a specialized educational environment for the patient with similarly disabled peers. Such an out-of-district placement was eventually found and the patient was successfully placed into a school setting composed along the lines of an "educational therapeutic community" where teachers and staff were all on the same page regarding the patient's difficulties both with cognitive function and behavioral/emotional difficulties. The school chosen for this patient was equipped to deal with her obsessional characteristics, incessant food seeking, as well as her emotional lability.

Children with Prader-Willi Syndrome exhibit a range of neurocognitive, behavioral, and emotional/social problems that present significant challenges to their parents, the school system, and communities. Such children might be said to be uniquely disabled with their particular blend of cognitive abnormalities, voracious appetite, and food seeking behavior, obsessive/compulsive features, emotional lability, conduct-disorder behaviors and other factors. The pediatric neuropsychologist brings an important perspective in understanding such children and providing for their treatment and intervention plans. Neuropsychological assessment is useful in determining specific learning and memory profiles, cognitive strengths and weaknesses, and identify other areas requiring intervention. The results of comprehensive testing inform educators about special needs and learning styles, typically not documented in non-neuropsychological evaluations. With such a comprehensive evaluation of these patients, parents and professionals involved in aspects concerning their education, emotional support, and social development can plan for their needs having a more in depth understanding of particular strengths and weaknesses. In that vein, the neuropsychological evaluation of such children makes an important contribution to their overall care.

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Baron, I.S., Fennell, E.B. and Voeller, K.K.S. (1995). Pediatric Neuropsychology in the Medical Setting. New York: Oxford.

factors, including when in development the migration is occurring, the distance between zones, and the thickness of the specific cortical region (Baron et al., 1995). Neurons then reach their final destinations during the proliferation stage, with the connectivity between neurons being adjusted through the pruning phase (Baron et al., 1995).

Recent research has indicated that cortical development and functions are becoming much better understood, particularly when viewed from a developmental perspective (Mitrofanis and Guillery, 1993, as cited in Baron et al., 1995). According to Spreen and colleagues (1995), during the fetal period, the development of the cortical hemispheres is rapid, whereas the cerebral commissures emerge slowly and are related to the growth of the association cortex. Postnatally, and continuing on through the first year of life, the primary sensory and motor areas are the most advanced, with the sensory association areas progressing next, followed by the parietal and temporal association zones. Although the prefrontal areas are present at birth, these areas do not demonstrate accelerated development until the second year of life. Throughout childhood, the myelination of neurons continues and is commensurate with the emergence of abilities, such as language.

Specific functional systems, including motor and language, mature first and myelinate more quickly then other functional systems. The motor system involves two semi-independent systems, the pyramidal and extrapyramidal, which govern the initiation of voluntary movement and the monitoring of motor movements, respectively. Early in the gestational period, the motor system begins to develop and continues throughout childhood, with individuals meeting motor milestones in a sequential, albeit a variable, pattern. Those systems crucial to language development (i.e. auditory and visual systems) emerge early in infancy. Nonetheless, the developmental milestones associated with language are related to the growth of more specialized areas of the brain, including subcortical CNS structures and the connections between these structures and the cortex (Spreen et al., 1995).

Case Example:

J.R. is a patient who was evaluated longitudinally on four separate occasions over the course of seven years (1998-2004). He was assessed with a variety of neurodevelopmental measures between the ages of two and three. He then received neuropsychological testing at the age of five and eight. J.R. was the product of a full-term gestational pregnancy weighing 9 lbs. He was delivered by emergency C-section due to an acute onset of fetal bradycardia during active labor after his mother suddenly hemorrhaged. At birth, he was noted to be "floppy and blue" with no respiratory effort. His heart rate was approximately 40. Apgar scores were 1 at one minute, 2 at five minutes, 3 at ten minutes, and 4 at fifteen minutes. J.R's tone was nonexistent and he was intubated shortly after birth.
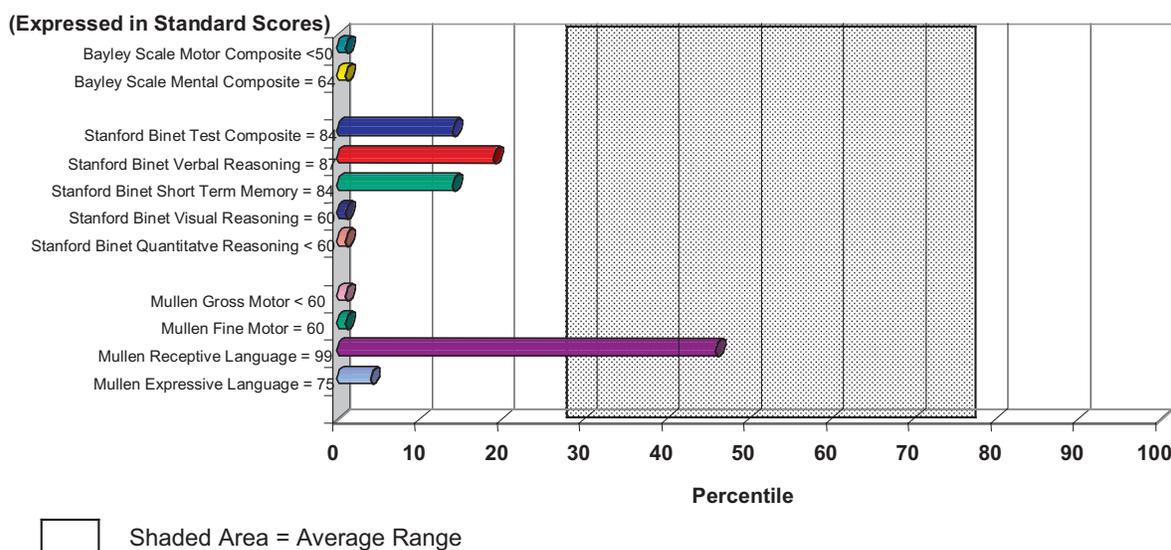
Upon arriving in the NICU, J.R. experienced decreased oxygen saturation, thus requiring a chest tube. Soon after, seizure activity was observed and he was prescribed Phenobarbital. Once the seizure activity subsided, he was then placed on Dilantin, although he did not seize again and was weaned off medication twelve months later. A CT scan of the head showed white matter abnormalities implicating the perivascular region on the left side. An EEG was completed at 2 days of age which indicated a burst suppression pattern consistent with perinatal asphyxia. J.R. had a positive gag reflex and his pupils were reactive to light, although he remained difficult to arouse for feeding, was sluggish, and hypotonic. At discharge (10 days of age) a diagnosis of hypoxic-ischemic encephalopathy was provided and early intervention services initiated. Early childhood development was significant for delays in gross motor development (he did not walk until 23 months of age) and he displayed a right-sided hemiparesis. Language domains were secure with respect to speech initiation at the time of his first birthday and two word utterances were observed by 24 months of age.

Assessment Results:

At the time of the first assessment, J.R. was 27 months old. He was actively involved in the Early

Intervention Program in his community and an updated developmental assessment was requested. J.R. was unable to complete the Stanford Binet Intelligence Scale-IV due to his significant developmental delays; however, he was able to be assessed with the Mullen Scales of Early Learning. He consistently performed two standard deviations below the mean across the domains measuring gross motor, fine motor, and visual reception (1st percentile). Low average performance was noted on measures of receptive language (14th percentile) and borderline ability for expressive language skills (4th percentile). J.R. continued to receive occupational, physical and speech therapies to address his right sided weakness, articulation delays, and upper extremity incoordination.

The second assessment occurred one year after the initial evaluation. J.R. was able to complete more testing, with the addition of the Bayley Scales of Infant Development-II and the Stanford Binet-IV. J.R. was three years of age during this testing and he obtained the following test results:

(Expressed in Standard Scores)

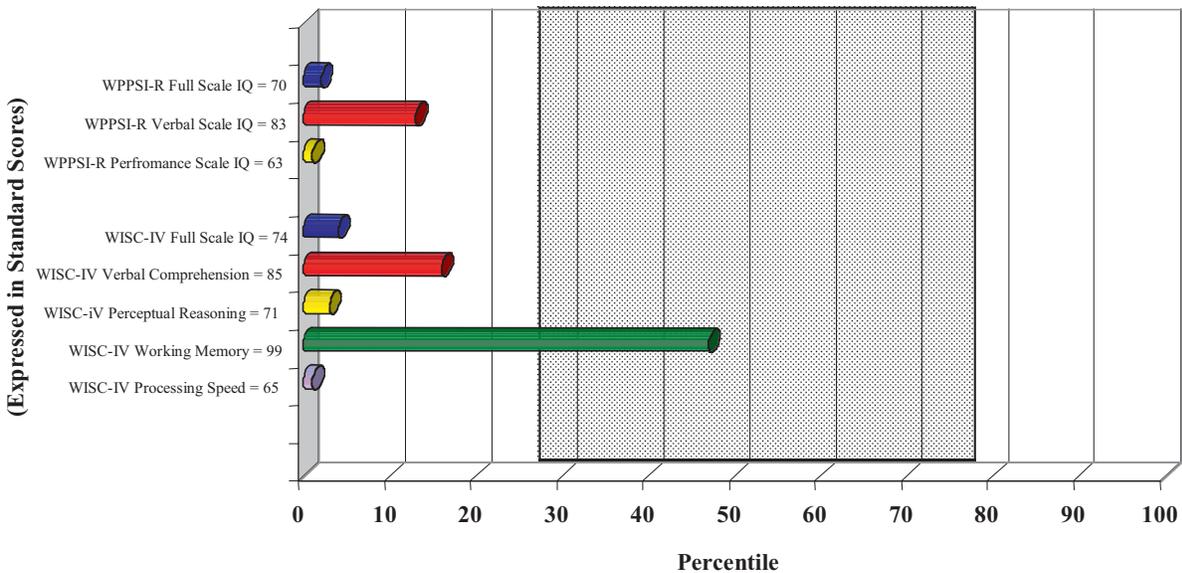|	Percentile
Bayley Scale Motor Composite <50	
Bayley Scale Mental Composite = 64	
Stanford Binet Test Composite = 84	
Stanford Binet Verbal Reasoning = 87	
Stanford Binet Short Term Memory = 84	
Stanford Binet Visual Reasoning = 60	
Stanford Binet Quantitatve Reasoning < 60	
Mullen Gross Motor < 60	
Mullen Fine Motor = 60	
Mullen Receptive Language = 99	
Mullen Expressive Language = 75	

☐ Shaded Area = Average Range

Assessment with the Vineland Adaptive Behavior Scale was also completed at the Early Intervention Program when J.R. was only 12 months old. The results from this measure coupled with the two neurodevelopmental assessments confirmed the deficits in visual-motor skills, while showing more preserved language skills (see below):

Domain	Degree of Developmental Delay in Months		
	1 year of age	2 years of age	3 years of age
Cognitive Index	2	10	11
Communication Index			
Receptive	2	4	2
Expressive	2	9	10
Motor Skills	4	12	24
Gross	5	11	22
Fine	4	14	23
Adaptive Behavior	3	11	21

The chart above highlights the increased delays in motor skills over time, while receptive language capability remains constant. Moreover, the expressive deficits that were observed were thought to be exacerbated by dysarthric speech and articulation errors, rather than a formal language based deficit.

The two most recent assessments of neuropsychological function were consistent with the early developmental profile of scores shown above. When J.R. was 5 years of age, the WPPSI-R demonstrated a very similar intellectual profile to the WISC-IV that was later administered at the age of eight.

Shaded Area = Average Range

J.R. was assessed most recently with a number of neuropsychological instruments that continued to denote his strengths in verbal processing and weaknesses within visual-motor skill.

Test	Standard Score	Percentile	Range
Woodcock Johnson-III –Achievement:			
Letter-Word ID	96	39th	Average
Word Attack	96	40th	Average
Calculation	99	49th	Average
Spelling	88	20th	Low Average
Passage Comprehension	85	16th	Low Average
Peabody Picture Vocabulary Test-III	95	37th	Average
Expressive One-Word Picture Vocab Test	101	53rd	Average
Controlled Oral Word Association Test			
Letters	103	58th	Average
Category	93	32nd	Average
California Verbal Learning Test, Children's Edition			
Total Trials 1-5	81	10th	Low Average
Trial 1 Free Recall	100	50th	Average
Trial 5 Free Recall	78	7th	Borderline
List A Short-Delay	70	2nd	Borderline
List A Long-Delay	63	<1st	Impaired
List A Cued Long Delay	85	16th	Low Average
Learning Slope	63	<1st	Impaired

Children's Memory Scale

Story Memory	95	37th	Average
Story Memory Delayed	95	37th	Average
Visual Immediate Memory	88	21st	Low Average
Visual Delayed Memory	82	12th	Low Average

Rey Complex Figure Test

Copy	55	<1st	Impaired
Delayed Recall	57	<1st	Impaired
Delayed Recognition	<55	<1st	Impaired

Purdue Pegboard: Unable to Complete due to Motor Deficits
Strength of Grip:

Dominant (Left)	89	23rd	Low Average
Nondom (Right)	79	8th	Borderline

Finger Tapping:

Dominant (Left)	<50	<1st	Impaired
Nondom (Right)	<50	<1st	Impaired

Dev. Test of Visual-Motor Integration	61	<1st	Impaired

Behavior Rating Inventory of Executive Function   Within Normal Limits
Behavior Assessment System for Children & Self Report   Within Normal Limits – mild inattention

Interpretation of Test Results:

J.R.'s profile of scores emphasizes the effect that perinatal factors can play on motor skills development, even for the full-term infant. In fact, J.R.'s language development was less affected and appears to have progressed better over time. Within the field of neuropsychology, one of the obstacles in the process of performing an evocative neuropsychological evaluation is the selection of the appropriate assessment materials in order to make accurate diagnoses and to provide meaningful recommendations for treatment. While several neurodevelopmental measures exist, many lack appropriate psychometric properties, including predictive validity. In fact, many children with developmental disabilities are often excluded from the norming sample (Boyd, Welge, Sexton, and Miller, 1989). While some measures, including the Mullen Scales of Early Learning (MSEL) and the Bayley Scales of Infant Development-II (BSID-II), have attempted to overcome these limitations, some challenges remain.

Studies have indicated that both the BSID and the MSEL lack predictive validity for later intelligence in childhood. This is particularly true with regard to children who were assessed prior to 18 months of age (Crowe, Deitz, and Bennett, 1987; Bradley-Johnson, 1997, 2001). For those children assessed after the age of 18 months, the predictive power of cognitive measures increases (Harris, 1987). Additionally, the MSEL has been shown to discriminate between low birth-weight (LBW) and normal children.

Research completed by Vohr, Garcia-Coll, and Oh (1988, 1989) found that children with LBW scored significantly lower on both the Receptive and Expressive Language Scales than the children with appropriate birth weight. More recent studies of the Bayley Scales of Infant Development-II (BSID-II) note that for those infants with severe medical conditions, the BSID-II is able to delineate the developmental changes as they evolve during the first two years of life (Niccols and Latchman, 2002). In fact, for children

with a primary diagnosis of perinatal asphyxia, the BSID-II demarcated a decrease in both the mental and motor performances, although motor performances were relatively more impaired than mental performances (Bayley, 1993). This was certainly the case for J.R., as his motor delays were the most prominent neurodevelopmental deficit, which was observed initially with the BSID-II. However, the MSEL showed a marked difference in receptive versus expressive language abilities. It also differentiated specific areas of weakness in upper versus lower extremity motor skill.

Correlational studies using the BSID-II and the WPPSI-R indicated the highest correlations between the BSID's MDI and FSIQ (.73) and VIQ (.73) on the WPPSI-R, while the PDI moderately correlated with the FSIQ (.41) (Bayley, 1993). While the BSID-II may correlate reasonably with intelligence measures (Bradley-Johnson, 2001), the measure by itself is not intended as an intelligence test for children (Bayley, 1993). However, it is important to note the trend in strengths and weakness, namely verbal versus visual processing skills, that are apparent in J.R.'s profile of scores across repeated measures in testing.

Although past research has documented a lack of strong predictive validity for both the MSEL and the BSID-II with respect to intelligence, the results from this case study highlight the importance of qualitative factors that exist and are crucial in treatment planning. The patient demonstrated significant motor delays in both fine and gross motor on each measure when he was first assessed at the age of 2 years and he continued to exhibit these impairments when assessed at later stages in his development. Given that J.R. had a primary diagnosis of perinatal asphyxia and was initially assessed after 18 months of age, these factors support prior research noting that the BSID-II, and to a greater extent the MSEL, are sensitive in identifying motor deficits with children with developmental disabilities and medical conditions. Findings from this case also bring to light developmental challenges that a full-term infant diagnosed with cerebral palsy may endure. Indeed, this case lends credence to the sensitivity of neurodevelopmental measures predicting deficits in full-term infants with perinatal asphyxia.

It is important to note that the MSEL provides the clinician with additional scales that can help make therapeutic recommendations to a child diagnosed with cerebral palsy. As was found in the testing, the five subtests that are available with the MSEL can help the neuropsychologist to identify specific areas of motor function that are affected. For example, more specific recommendations can be provided to both the occupational and physical therapist with respect to writing capability, pencil grip and grasp, as well as balance issues and difficulties with low tone.

Discussion:

The results of repeat neuropsychological assessments in this case example demonstrate that J.R. presented with negative sequelae that are directly attributable to his HIE and diagnosed condition of cerebral palsy. These difficulties have compromised his ability to carry out typical academic tasks. Specifically, two converging problems that limit him from showing his true potential include his compromised manual motor dexterity when writing and poor speed of processing.

In addressing motoric difficulties, J.R. continues to have difficulty with fine motor tasks such as manual speed and dexterity (right and left-hand), writing, and bilateral hand mechanics. As manual motor functioning is crucial in early elementary learning, especially in the area of spelling and written expression, J.R. was indeed struggling in these areas. Although his visual skills may be more intact on some exercises, his ability to perform quickly and efficiently on precise and fluid writing tasks was a significant weakness. When he was able to perceive visual/spatial information accurately, his writing difficulties were most attributable to motor output deficits. J.R. demonstrated marked difficulty with letter formation, sizing, and writing mechanics, although his writing thematically and technically was adequate.

Bernstein (2000) recently summarized various neurodevelopmental approaches involved in neurospcyhological assessment. Of critical importance is that the clinician have an advanced knowledge of discrepancies with regard to

biobehavioral circumstances of children at different phases of development. Thus, at the core of the neurodevelopmental approach is to address the current presentation of the child. Therefore, the biobehavioral and developmental characteristics of the child should be integrated into the interpretative process. In the case of J.R. it was essential to understand the neuropathological condition of cerebral palsy and HIE. Incorporating knowledge of neurodevelopment into the interpretation process allows for a more complete understanding of the child. For instance, since J.R. experienced an anoxic insult surrounding the time at birth, this coincides with the continuing neurodevelopment of the motor and sensory areas in the brain. Therefore, it should not be surprising that he has significant motor impairments. It is also worth noting that for full term infants, asphyxia is more commonly associated with lesions in the basal ganglia and cerebral cortex, further supporting delays in motor development. In addition, while EEG and CT findings indicate left hemisphere compromise as a result of the insult, the patient's language abilities were spared and did not show significant signs of delay. These findings could be explained by the fact that language areas of the brain often develop after more specialized areas of the CNS. Furthermore, neural migration could also account for the preservation of language development.

With regard to understanding early neuro-developmental factors that will impact later childhood functional capability, it is encouraging to note that the recent revision of the Bayley Scales is now incorporating multiple subtests scores. This will help the clinician to continue making recommendations for treatment and early intervention that are more helpful.

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work value are great examples of the positive power of advocacy. With help from Division 40, NAN, and other organizations, the APA Practice Directorate, through almost a decade of persistent effort, has finally convinced AMA/CPT governance to recognize the uniqueness and quality of neuropsychological services and to remunerate psychologists accordingly. Another excellent example is the Graduate Psychology Education Program, the only federal program dedicated specifically to Psychology education and training. This unique program was established in the Bureau of Health Professions in FY 2002 with an appropriation of $2 million to meet the demonstrated need for integrated health care services, including psychological and neuropsychological services, for underserved populations in rural and urban areas. Appropriations for this program would simply not have occurred without strong grassroots advocacy from individual psychologists and neuropsychologists and without legislative champions in Congress and without the unwavering support of the APA Education Directorate. With other federal priorities looming, continued appropriations for psychology education would already have been eliminated were it not for vocal advocacy from the grassroots. Why do legislators listen to grassroots efforts? Because ultimately, legislators want to make good policy, and because you vote. Legislators also want to get re-elected.

OK, so maybe this advocacy thing works once in a while, but some feel that such efforts don't pay off immediately (the "work value" decision described above took a full decade), and many people just don't know how to get involved. Division 40 has an Advisory Committee structure that permits us to be cognizant of major advocacy needs in Practice, Education, Public Interest/Public Policy, and Science, and I would urge you to become involved by selecting just one issue or domain that it is of special interest to you and by contacting the appropriate Advisory Committee Chair or Committee member to find out how to get involved.

Let me briefly illustrate how input from neuropsychologists might have a positive impact in the broader sense. In Practice, the use of technicians in neuropsychological assessment continues to command attention in several states (our colleagues in New York, for example, have recently taken up vocal advocacy of this issue), and the actual implementation of the new CPT codes will require diligence and continued effort on the part of all neuropsychological practitioners. In Education, initiatives to rededicate ourselves to the high but achievable standards of education and training described in the Houston Conference document are underway, and Division 40 plans to support and participate in an upcoming national conference on developing training models for clinical geropsychology . In Public Interest, many issues from the local to the federal level are suitable for advocacy. Addressing racial and ethnic disparities in health care availability, addressing the special needs of the very young and elderly, and focusing on improving neuropsychological services given to underserved populations are key ongoing concerns. Individual neuropsychologists can also have impact at the local and state level as well. For example, when city commissions or state legislatures consider ordinances or statues that will potentially affect neuropsychological morbidity in the population (e.g., environmental legislation, enacting optional helmet laws for motorcycle riders) neuropsychologists can and should provide public health impact statements, within the limits of their competency, that educate concerned stakeholders. In Science, neuropsychologists need to be more active and more vocal about the shrinking federal support of neurobehavioral research and research training, and need to bring public attention to recent developments in neurobehavioral science that can make a difference in people's lives.

What issues are important to you? What are the major problems you face in your day-to-day lives as neuropsychologists? How might you have an impact on framing, defining, or solving these problems? What special contributions do neuropsychologists make in the healthcare, educational, and scientific workplace that should be better showcased? What unique talents, knowledge, or skills can you donate to the cause? As President of Division 40, I can tell you how proud and grateful I am to be associated

with this Division, and that our incredibly talented and dedicated slate of Executive Committee officers, members, and committee chairs is hard at work on your behalf. But we need to hear from you, need your support, and most of all, need a little "elbow grease" from each member of the Division if we are to advance the science and practice of Clinical Neuropsychology in the years to come.

Pediatric Neuropsychologist
Assistant or Associate Professor
University of Washington

The Department of Psychiatry & Behavioral Sciences is seeking applicants for a faculty position as an Assistant or Associate Professor in the Academic Track within the Child and Adolescent Psychiatry Division. This position requires a PhD with expertise in child and adolescent neuropsychology and demonstrated research productivity. The position includes directorship of a busy neuropsychological assessment service, clinical supervision/training of psychology graduate students, psychology interns, and child psychiatry fellows, and the further development of an independent research program. The appointee in this position is expected to work independently performing experiments, teaching and supervising students and writing research articles and grants. The successful candidate should therefore have a record of published research and have obtained or demonstrated the potential to compete successfully for extramural research funding. The Child Division is housed within Seattle Children's Hospital which provides opportunities for collaboration with pediatric and pediatric surgical subspecialities. Please send letter (reference Search #66) and curriculum vitae by 9/05/05 to Richard Veith, MD, Chair, Psychiatry & Behavioral Sciences, UW Box 356560, Seattle, WA 98195-6560. The University of Washington/Harborview Medical Center is building a culturally diverse faculty and strongly encourages applications from women and minority candidates. The University of Washington/ Children's Hospital and Regional Medical Center is an equal opportunity, affirmative action employer.

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