Neurocognitive Habilitation Therapy for Children With Fetal Alcohol Spectrum Disorders: An Adaptation of the Alert Program®

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KEY WORDS

- alcohol-related disorders
- child behavior disorders
- cognitive therapy
- fetal alcohol syndrome
- social behavior

OBJECTIVE. This study evaluated the effectiveness of neurocognitive habilitation, a group therapy intervention for foster and adoptive caregivers and their children who were prenatally exposed to alcohol.

METHOD. Participants were recruited from clients seeking evaluation for fetal alcohol syndrome (FAS) and alcohol-related neurodevelopmental disorder (ARND) and were randomly assigned to treatment and no-treatment control groups. Forty children participated in the treatment program and were compared with 38 control participants using the Behavior Rating Inventory of Executive Function (BRIEF) and the Roberts Apperception Test for Children (RATC).

RESULTS. Significant differences between the treatment and control groups were demonstrated on the BRIEF and on the RATC, suggesting that the intervention improved executive functioning and emotional problem-solving skills.

CONCLUSION. These findings yield promising evidence of the effectiveness of the neurocognitive habilitation intervention in improving executive functioning and emotional problem solving in children with FAS or ARND.

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Since the identification of fetal alcohol syndrome (FAS) in 1973 (Jones, Smith, Ulleland, & Streissguth, 1973), appreciation of the effects of prenatal alcohol exposure on a child's emotional, behavioral, and cognitive development has grown. The diagnosis of FAS is made on the basis of three criteria: (1) prenatal and/or postnatal growth retardation, (2) central nervous system (CNS) impairment, and (3) characteristic facial dysmorphology (National Institute on Alcohol Abuse and Alcoholism, 2000). Alcohol-exposed children who do not meet full criteria for FAS can still exhibit subtle neurodevelopmental deficits, resulting in diagnoses of partial FAS, alcohol-related birth defects, or alcohol-related neurodevelopmental disorder (ARND), which together are thought to occur 3 to 4 times more frequently than diagnosed cases of FAS (Sampson et al., 1997).

Several studies have explored specific aspects of executive functioning in children exposed to alcohol prenatally. The most common problems include deficits in selective inhibition, verbal and nonverbal fluency (Kodituwakku, Handmaker, Cutler, Weathersby, & Handmaker, 1995; Schonfeld, Mattson, Lang, Delis, & Riley, 2001), arousal and attention (Brown et al., 1991), problem-solving strategies (Kodituwakku, May, Clericuzio, & Weers, 2001; Roebuck-Spencer & Mattson, 2004), planning (Kopera-Frye, Dehaene, & Streissguth, 1996; Mattson, Goodman, Caine, Delis, & Riley, 1999), and working memory

(Jacobson et al., 1998; Rasmussen, 2005). Moreover, several investigations have suggested an association between executive functioning and self-regulation (Geva & Feldman, 2008). Difficulties with *self-regulation,* or the ability to manage internal sensory, emotional, behavioral, and bodily states, are frequently observed in children with histories of prenatal alcohol exposure (Barkley, 2001; Mayes, 2000).

Difficulties with emotional functioning present another level of challenge for children following prenatal alcohol exposure. It is not uncommon for these children to overreact to what others consider to be relatively benign triggers or precipitants. Often, these difficulties intensify as a child progresses through school, especially as social relationships become increasingly complex. Problems with emotional self-regulation result in difficulties making and keeping friends, which in turn may compromise a child's self-esteem and emotional functioning.

In an attempt to improve the daily functioning of children prenatally exposed to alcohol, we developed a group treatment approach, termed *neurocognitive habilitation,* that teaches children to recognize individual deficit areas and to develop strategies to compensate for areas of weakness, all while building on existing skills and strengths. The development of this group treatment model integrated techniques and interventions used in therapy for traumatic brain injury (TBI; Dykeman, 2003) with components of the Alert Program® (Williams & Shellenberger, 1996), a curriculum that helps children improve self-regulatory skills by teaching them first how to identify their arousal level and then how to choose appropriate interventions to alter their arousal level on the basis of situational demands. Neurocognitive habilitation is based on the premise that difficulties with self-regulation contribute to the day-to-day challenges experienced by children with FAS and ARND, including executive functioning deficits. The study described in this article tested the hypothesis that neurocognitive habilitation group therapy services would improve executive functioning and emotional and social problem-solving skills in children with FAS and ARND.

Method

Research Design

This trial was designed as a randomized controlled study. Children and families were randomly assigned to either the intervention or the no-treatment control group. Repeated follow-up measures were administered 7 months after enrollment, which was usually 2 to 3 months after treatment concluded, by psychologists blinded to the child's group assignment. Treatment and control participants were recruited from among the Illinois Department of Children and Family Services (DCFS) general child welfare population and children living in adoptive homes. The foster or adoptive parent and, as appropriate, the Office of the Guardian of DCFS signed consents for the children's participation in the study. In addition, eligible children were given verbal and written information about the study and signed an assent. The institutional review boards of the DCFS and of the Centers for Disease Control and Prevention approved all procedures for this study.

Participants

All children included in the initial screening for the project were between 6 yr old and 11 yr, 11 mo old, were in out-of-home placement, and had been removed from their birth families because of prenatal substance exposure or ongoing parental substance abuse in the home. We verified each child's prenatal alcohol exposure through documentation in the child's birth, medical, child welfare, and (if applicable) adoption records. In addition, maternal use of tobacco and illicit drugs was documented through maternal admission of use or positive toxicology for the mother or newborn. We evaluated each child's general health, neurological functioning, and developmental status through a review of the child's health, behavioral health, adoption, child welfare, and school records and through a full medical, neurological, and dysmorphology examination. Children with a history of serious head trauma, current or historical evidence of lead poisoning, or evidence of a genetic or dysmorphic syndrome other than FAS were excluded from the study. Exposure to illicit drugs, such as marijuana or cocaine, did not exclude a child from the project as long as he or she met the criteria for FAS or ARND.

A digital facial photograph of each child was taken following the guidelines established by Astley and Clarren (2000, 2001). Measurements of palpebral fissure length and intercanthal distance were calculated via the photograph using the recommended formulae. The philtrum and lip ranks (1 through 5) were assigned by the examining pediatrician on the basis of an established grading system (Astley & Clarren, 2000, 2001) and were confirmed by examination of the child's facial photograph by a second pediatrician and through computer-generated upper lip circularity calculations. All children also underwent a comprehensive neuropsychological evaluation, as described previously (Chasnoff, Wells, Telford, Schmidt, & Messer, 2010), to determine CNS functioning. Following the comprehensive evaluation, children were assigned an alcohol exposure–related diagnosis on the basis of the following criteria:

- *Growth retardation:* Current or past weight or height less than the 3rd percentile, adjusted for age and gender
- *Facial dysmorphology:* Abnormal measurements of the upper lip (Rank 4 or 5) and the philtrum (Rank 4 or 5) and shortened palpebral fissures according to analysis of facial features using a lip-philtrum guide and digital facial photograph criteria of Astley and Clarren (2000, 2001)
- *CNS abnormalities:* Demonstration of structural, neurological, or functional CNS deficits as documented by the presence of microcephaly (current head circumference below 3rd percentile for age and gender) or functional deficits demonstrated as global cognitive delays with performance below the 3rd percentile on standardized testing, *or* three or more domains of neurodevelopmental functioning more than 2 standard deviations below the normed mean on standardized measures of cognitive, executive, memory, adaptive, motor, attentional, social skills, or sensory functioning.

Children who had growth impairment, all physical criteria for facial dysmorphology, and evidence of neurodevelopmental deficits were assigned a diagnosis of FAS. Children who had confirmed alcohol exposure and met criteria for neurodevelopmental deficits but did not meet the criteria for facial dysmorphology were classified as ARND (Chasnoff et al., 2010).

Following the initial screening, the psychologist performing the screening offered enrollment into the study to 90 children with a confirmed history of prenatal alcohol exposure who met criteria for FAS or ARND. Twelve families declined because of geographic distance between their home and the clinical program; thus, 78 children were enrolled. After consents were obtained, children and families underwent the baseline research evaluation. The children were then placed into groups using simple random assignment by means of a table of odd and even random numbers. No predetermined allocation sequence was used. Forty children were randomized into the treatment group (27 boys, 13 girls), and 38 children were randomized into the control group (26 boys and 12 girls).

Materials

Conceptualization of the Neurocognitive Habilitation Program. The overarching therapeutic goal of the neurocognitive habilitation program was to improve executive functioning skills and emotional regulation related to the children's home and school environments. To increase the children's capacity for executive functioning, we addressed their ability to self-monitor and ultimately self-regulate by incorporating components of the Alert Program. We also incorporated treatment strategies used with the pediatric TBI population, such as occupational therapy and family psychoeducation, as well as interventions designed to improve memory skills, emotional awareness, and cause-and-effect reasoning.

Over the course of the neurocognitive habilitation program, the children's caregivers participated in psychoeducational groups in which they were provided information about FAS and ARND. The research literature has demonstrated parent training to be an effective independent intervention (Price et al., 2008; Schrepferman & Snyder, 2002), and other researchers have successfully added parent components to treatment with children (Reid, Webster-Stratton, & Hammond, 2007). The neurocognitive habilitation curriculum teaches caregivers to recognize precipitants to changes in their child's arousal level, to respond to the child in ways that elicit a desired emotional and behavioral response, and to implement strategies designed to engage the child in reciprocal and meaningful activities by providing accommodations that address the child's specific developmental needs.

Neurocognitive Habilitation Curriculum. The neurocognitive habilitation curriculum we used expanded on components of the Alert Program, a 12-week curriculum for children with FAS and ARND and their families; Table 1 summarizes the curriculum used in this study. Caregiver and child groups lasted approximately 75 min and were conducted concurrently by doctoral- and master's-level therapists, including an occupational therapist, who had extensive experience with child-based interventions. Intervention fidelity was maintained through use of a treatment manual by all therapists throughout the intervention. In addition, the therapists who implemented the intervention frequently met with each other to discuss therapy implementation and fidelity issues.

Each intervention session followed the same basic schedule to help the children transition from one activity to another: check-in and review, group activity or learning concept, sensory snack, wind down and art activity to be inserted in each child's Strength Book, return to and review with the caregivers, and group goodbye ritual. Each week, the therapists reviewed core concepts with both the caregivers and the children to promote memory consolidation via repetition and repeated exposure. During check-in, the therapists provided the children with a "fidget toy" (e.g., a straw or plastic bendable figure) with the general instruction, "This is something to keep your

Table 1. Overview of Child and Caregiver Sessions

Week	Child Sessions	Caregiver Sessions
1	"Invitation to Learn, Grow, and Share: Different Games for Different Brains"—Group leaders facilitate introductions via use of a musical name game and provide an overview of the purpose of the group. Group rules are devised, and issues pertaining to confidentiality and respect are discussed. Using the metaphor of an automobile engine for the human brain and body, facilitators introduce the concept of self-regulation. Just as a car engine runs in low, just-right, and high gears, so does the brain. Once they learn how to identify what gear their "engine speed" is in, they can then learn to make adjustments depending on the situation.	"Understanding the Effects of Alcohol Exposure and the Need for Intervention"—Group leaders facilitate introductions and describe the curriculum. Caregivers are asked to share a little bit about their child, including areas of concern and strength. Group leaders briefly explain the physical and neurocognitive effects of prenatal alcohol exposure and introduce the four intervention concepts emphasized throughout the curriculum: self-regulation, memory skills, emotional awareness, and cause-and-effect reasoning. Group leaders note that each week they will review the topic areas covered in the children's group to promote continuity of interventions in the home environment.
2	"Self-Regulation: Feelings and Behaviors"—Group members participate in experiential activities to learn to identify when their "engine" is running in low, just-right, and high gear. Leaders reinforce the idea that although they sometimes need to adjust their engine speed to fit the demands of a situation, there are times when they need their engines to be in low or high gear.	"Understanding the Effects of Alcohol Exposure, Part 2"—Via use of a PowerPoint presentation, group leaders facilitate a discussion about the effects of prenatal alcohol exposure, including, but not limited to, physical characteristics; central nervous system effects; behavioral, emotional, and thought dysregulation; information processing deficits; and idiosyncratic recording and storage of memories. Brain slides of people affected by prenatal alcohol exposure are discussed to help caregivers reframe their understanding of their child's struggles and challenges.
3	"Self-Regulation: Feelings and Behaviors, Part 2"—Group leaders introduce the Engine Speed Chart to help members label their "engine levels" while participating in activities throughout the course of a typical day.	"Intervening With Emotional and Behavioral Effects of Sensory Integration Deficits"—Group leaders provide a basic overview of sensory integration theory, optimally with the help of an occupational therapist who is trained in sensory processing disorders. The caregivers discuss the ways sensory dysregulation affects their child's behaviors and emotions.
4	"Memory, Planning, and Behavior"—Group members learn steps for planning ahead and sequential thinking through active songs and movement.	"Sensory Integration Deficits, Part 2"—Using the Sensory–Motor Preference Checklist for Adults (Williams & Shellenberger, 1996), caregivers assess their individual sensory–motor preferences. Group leaders then provide an overview of sensory strategies and techniques that help both children and adults adjust their arousal levels. Caregivers are encouraged to help their children practice sensory strategies in the home environment.
5	"Sensation and Emotion"—Group leaders introduce progressive muscle relaxation techniques to enable the children to adjust their arousal levels. Self-awareness is promoted as the group members learn to understand their feelings by visually indicating with art where in their body they feel certain emotions.	"Caregiver Self-Care"—Group leaders lead a discussion about caregiver self-care. Caregivers are asked to reflect on barriers to self-care and strategies to get around such barriers. Finally, caregivers receive progressive muscle relaxation training and are instructed to practice these techniques with their children.
6	"Review and Renew"—Group members review and practice self-regulation, memory, and emotional awareness tasks to enhance skill areas and reinforce learning.	"Memory Deficits in Alcohol-Exposed Children"—Group leaders lead a discussion related to memory functioning in children with prenatal alcohol exposure, including the related brain structures that can be affected by alcohol prenatally. They introduce strategies for promoting memory consolidation and retrieval.
7	"Emotions and Planning"—Group members continue to learn about emotional awareness and expression by learning how to identify feelings visually and by acting out their feelings through various games.	"Helping Your Child Think Ahead and Solve Problems: Cause-and-Effect Thinking"—Caregivers are taught various problem-solving strategies to use with their child, including a five-step approach: (1) What is the problem? (2) What are my options or solutions? (3) Which is the best solution to use? (4) Apply the solution. (5) Evaluate the results: If successful, give positive feedback; if not, return to the second step.
8	"Social Skills and Problem Solving"—Via animal pictures that depict several different coping styles, group members increase self-awareness by participating in role-plays that illustrate each of the coping styles.	"Problem Solving, Part 2"—Caregivers participate in experiential role-plays to practice a five-step problem-solving approach with their child. Group leaders also review the coping styles in the animal pictures presented in the children's group and encourage caregivers to think about their personal coping styles and how their approaches to problem solving compare with their child's.
9	"Thinking and Planning"—Group members continue work on strategies that promote emotional awareness and cause-and-effect reasoning through the use of comic strips and illustrated stories.	"How to Be an External Brain"—Group leaders introduce the concept of *being an external brain,* or providing optimal levels of structure, guidance, and support so children internalize good habits and routines.

(*Continued*)

Table 1. Overview of Child and Caregiver Sessions (*cont.*)

Week	Child Sessions	Caregiver Sessions
10	"Emotions and Self-Esteem"—Children increase emotional awareness skills and learn about self-esteem by exploring maladaptive or hurtful thoughts. The concept of "Mr. Mean," or our inner critic, is introduced. Group leaders instruct the children on ways to identify Mr. Mean and stop Mr. Mean.	"Understanding Self-Esteem in Children With Developmental Disabilities"—Group leaders lead a discussion about self-esteem, including the impact of a FAS or ARND diagnosis on the child's self-concept. Group leaders help caregivers brainstorm strategies for improving the way their children feel about themselves. The voice of "Mr. Mean" is introduced, and caregivers reflect on their own inner critic. Caregivers also think about and share their feelings about raising a child with FAS and ARND. Finally, group leaders help caregivers identify strategies for combating negative self-statements in both themselves and their children.
11	"Emotions and Self-Esteem, Part 2"—Group members learn about self-esteem through activities that highlight individual uniqueness, strengths, and positive qualities. They also practice strategies to enhance self-esteem. Group leaders prepare the children for the last session, including a discussion about the many feelings they might have when it is time to say goodbye.	"Review of Discussion, Techniques, and At-Home Progress"—Group leaders review the four general topics covered over the course of program: self-regulation, memory, emotional awareness, and cause-and-effect thinking. Group leaders answer any questions caregivers have about implementing techniques and making individual adjustments to fit their child and family. Group leaders prepare caregivers for the final group session.
12	"Conclusion and Graduation"—The final session is conducted with both children and caregivers present. Via a noncompetitive game format, children and caregivers review and practice concepts learned over the course of the past 11 wk. Children are individually awarded a Master Mechanic Certificate to celebrate their growth and achievement. Children are also presented with their Strength Book, which is a compilation of the learning exercises and art projects they completed in each of the sessions.	

hands busy while your ears are listening." The analogy of the Alert Program's "engine speed" was used with the children throughout the entire 12-wk curriculum, even when the focus of a particular session was on a different skill or concept. The final 15–30 min of each session provided an opportunity for caregivers and children to come together to practice what they had learned in that week's session.

Measures

The Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000a, 2000b) is a self-administered questionnaire completed by the primary caretaker that assesses executive function behaviors in the home and school environments. The BRIEF was designed for use with children ages 5–18 yr, including children with developmental, neurological, psychiatric, and medical conditions. It contains 86 items with eight theoretically and empirically derived clinical scales that measure multiple aspects of executive functioning. The clinical scales form two broad indexes, Behavioral Regulation and Metacognition, and an overall score, the Global Executive Composite. Estimates of internal reliability range from .80 to .98. Similarly, test–retest reliability estimates are high (.82 for parents and .88 for teachers). Convergent validity has been demonstrated with other measures of inattention, impulsivity, and learning skills, and divergent validity has been established against measures of emotional and behavioral functioning.

The strength of the BRIEF lies in its ability to measure behavioral indicators of executive functioning as it manifests in the context of everyday situations. A study of children with a wide range of clinical diagnoses, including attention deficit hyperactivity disorder (ADHD), learning disabilities, and TBI, concluded that the BRIEF parent ratings are sensitive to aspects of executive functions that are not identified on performance-based measures often used in research settings (Bodnar, Prahme, Cutting, Denckla, & Mahone, 2007).

The Roberts Apperception Test for Children (RATC; McArthur & Roberts, 1982) was designed for children and adolescents ages 6 through 15 to assess their perceptions of common interpersonal situations. Children's responses are scored on scales measuring adaptive and maladaptive functioning (eight adaptive scales and five clinical scales) and providing t scores. The RATC was standardized on a stratified sample of 200 children ages 6–15. The RATC scoring system has shown adequate interrater agreement ranging from 55.5% to 97.6%. Likewise, split-half reliability estimates showed reasonable consistency ranging from .46 to .86. Validity of the RATC was shown by several analyses, including investigation of the relationships among the various RATC measures, examination of the relationships among the individual cards and the RATC measures, comparisons of RATC responses of well-adjusted and clinic children, comparisons of the RATC with other story-telling tests, and investigation of the use of the RATC as a psychotherapy outcome measure. In the current study, multiple psychologists were responsible for scoring the RATC. The interrater reliabilities between the psychologists for these diagnostic categories ranged between .44 and .98, with a mean reliability of .78. Although the range of interrater reliabilities begins relatively low, there was no effect on the eventual RATC scores.

The Wechsler Intelligence Scale for Children–Third Edition (WISC–III; Wechsler, 1991) was used to assess the children's global intellectual functioning. The WISC–III consists of 12 subtests that combine to form a Verbal IQ score, a Performance IQ score, and a Full Scale IQ score and four other indexes (Verbal Comprehension, Perceptual Organization, Freedom From Distractibility, and Processing Speed). Average reliability coefficients are .95, .91, and .96 for the Verbal IQ, Performance IQ, and Full Scale IQ scores, respectively, across all age groups. For the four factor indexes, the average reliability coefficients range from .85 to .94. The WISC–III also possesses stability over time; the corrected stability coefficients range from .85 to .96 for the Verbal, Performance, and Full Scale IQ scores and from .74 to .95 for the four index scores.

Data Analysis

Baseline data to determine comparability of the two randomized groups were analyzed using X^2 analyses for categorical data and t tests for noncategorical data. Because the research design was a repeated-measures design comparing 7-mo outcome data to baseline data, we used a *doubly multivariate analysis of variance* (MANOVA) approach to the data analysis, which is an extension of profile analysis. With this statistical technique, the multiple subscales of a measure are considered a profile, and three major questions about this profile are addressed: (1) Do the two different groups have parallel profiles (*parallelism,* the interaction effect)? (2) Does one group, on average, score higher on the combined subscales than the other group (*levels,* the between-groups effect)? (3) Are all the subscales the same at each measurement point in time (*flatness,* the within-groups effect)? This design is called *doubly multivariate* because the between-subjects part of the design is considered singly multivariate and the within-subject effects and interactions are considered doubly multivariate.

Following testing of the interactions and main effects, we conducted Roy-Bargmann stepdown analyses (Finch, 2007) to test all the dependent variables in successive analyses of covariance, using higher priority dependent variables as covariates, to determine whether each variable added to the combination of dependent variables already tested. This strategy provides an advantage over the more common use of univariate analyses of variance (ANOVAs) to interpret the results of the MANOVA because it eliminates the problems related to the correlations between the dependent variables and the resultant inflation of type 1 error (Tabachnick & Fidell, 2006). Data analyses were conducted with SPSS statistical analysis software Version 13.0 (SPSS, Inc., Chicago).

Results

Baseline Comparison of Treatment and Control Participants

The demographic characteristics of the treatment and control groups, including race and ethnicity as classified by the children's primary caregivers and DCFS, were similar, except that the mean age of the control group was significantly greater than that of the study group (Table 2). No differences were found in Verbal, Performance, or Full Scale IQ scores between the two groups (Full Scale IQs across both groups ranged between 45 and 138), and current family placement (adopted vs. foster care) was similar across the groups. In examining prenatal substance exposure patterns, no difference was evident between the treatment and control groups in the incidence of prenatal exposure to tobacco, $X^2(1) = 0.02$, $p = 1.00$, or cocaine, $X^2(1) = 1.33$, $p = .27$. Because the number of children exposed to other illegally used substances (marijuana, barbiturates, benzodiazepines, heroin and other opiates, and phencyclidine) was so small, these were collapsed into one category; the treatment and control groups did not differ in the incidence of prenatal exposure to these other substances, $X^2(1) = 0.35$, $p = .74$. About half the children in each group were currently being treated with a stimulant medication for ADHD. Twenty-one children met the criteria for FAS and 57 for ARND; the distribution of diagnoses was similar in the treatment and control groups. No significant differences were found between the two groups in the incidence of mental health diagnoses (Table 2).

Outcome on the BRIEF

A review of the distributions of the postintervention BRIEF subtests revealed 11 outliers on the baseline variables (2 on Shift, 1 on Initiate, 2 on Working Memory, 1 on Planning and Organization, and 5 on Monitor) and 6 outliers on the follow-up variables (1 on Emotional Control, 2 on Working Memory, 2 on Planning and Organization, and 1 on Organization of Materials), as well as skewed and leptokurtic distributions. Box plots revealed these outliers to be extreme. To reduce the impact of the 17 outliers, the scores on the outlying cases were assigned values close to the nonoutlying distribution values—that is, one unit larger than the next most extreme score in the

Table 2. Children's Characteristics, by Group

Characteristic	Treatment Group (n = 40)			Control Group (n = 38)				
	%	M	SD	%	M	SD	t/X^2	p
Gender							0.008	.93
Male	67.5			68.4				
Race or ethnicity							5.57	.23
White	30.0			44.7				
African American	47.5			36.8				
Hispanic	7.5			0				
Native American	0			2.6				
Mixed race	15.0			15.8				
Adopted	84.6			84.2			0.002	.96
Foster care	27.0			13.2			4.42	.35
Age (years)		8.12	1.48		9.24	1.36	−3.47	.001
Intellectual functioning								
Verbal IQ		91.25	16.79		91.37	15.66		
Performance IQ		90.10	15.23		92.32	19.84		
Full Scale IQ		89.68	15.94		90.97	17.62		
Repeated a grade in school	14.7			23.7			0.92	.34
Diagnosis								
Attention deficit hyperactivity disorder	67.5			73.7			0.36	.36
Anxiety disorder	5.0			7.9			0.27	.48
Attachment disorder	12.5			10.5			0.074	.53
Disruptive disorder	10.0			5.3			0.62	.36
Elimination disorder	12.5			15.8			0.17	.46
Mood disorder	10.0			26.3			3.52	.06
Posttraumatic stress disorder	22.5			10.5			2.012	.13
Prenatal exposure to other substances								
Tobacco	36.4			37.5			0.009	.92
Cocaine	56.8			44.1			1.13	.29
Other	22.5			21.1			0.024	.88
Fetal alcohol spectrum disorder								
Fetal alcohol syndrome	12			9			0.40	.82
Partial fetal alcohol syndrome	5			5				
Alcohol-related neurodevelopmental disorder	23			24				

Note. M = mean; SD = standard deviation.

distribution (Tabachnick & Fidell, 2006). After reassigning these values, most of the skewness and leptokurtosis disappeared, with the exception of skewness on the subscale Organization of Materials. To eliminate the negative skewness on this value, we reflected the values (i.e., we found the largest score in the distribution, added 1 to it to create a constant, and then subtracted every score from the constant to create a new variable) and took the square root (Tabachnick & Fidell, 2006). This transformation was successful in eliminating the skewness. We used this transformation because MANOVA assumes normality, and the skewed distribution was likely to have a negative effect on the analysis.

In analyzing all the subtests of the BRIEF in a multivariate test, the test of parallelism (interaction between group and time) was significant, F (8, 57) = 3.09, p = .006; the levels test (main effect for group) was significant, F (8, 57) = 2.61, p = .02; and the flatness test (main effect for time) was nonsignificant, F (8, 57) = 1.93, p = .07. This result indicates that the treatment group showed significant improvement that was attributable to the intervention. The strength of association for the interaction effect (η^2) was 0.30. The correlations between the subtests were moderate to high (.27–.80), indicating possible difficulty in determining which subtest accounts for the most variability in the significant MANOVA.

To better understand the statistically significant difference between the two groups' outcomes, we again used Roy-Bargmann stepdown F tests to examine the contributions of the dependent variables to the significant effect obtained in the MANOVA omnibus test. We prioritized the subtests in the following order on the basis of hypotheses regarding which executive functioning skills are most likely affected by the neurocognitive habilitation intervention (Tabachnick & Fidell, 2006): Emotional Control, Inhibit, Monitor, Shift, Initiate, Plan/Organize, Working Memory, and Organization of Materials. Table 3 presents the cell means for the groups at the two times of measurement and the corresponding stepdown *F*s. In the first step, an ANOVA was conducted in which group means on the most important variables were compared. In the next step, this variable became the covariate, and the means on the next most important variable were compared. This stepdown procedure continued with decreasing degrees of freedom at each step. Because there are eight subtests in this measure, the accrual of α was limited by dividing .05 by 8; the resultant α was .0062. None of the stepdown *F*s reached significance using this adjusted α level, suggesting that the significant effect between the groups is best understood as a combination of the subtests; that is, all aspects of executive functioning measured on the BRIEF accounted for the variance between groups.

Outcome on the RATC

For the RATC, a measure of emotional problem solving, the test of parallelism (interaction between group and time) was significant, $F(7, 52) = 2.92$, $p = .012$; the levels test (main effect for group) was significant, $F(7, 52) = 3.54$, $p = .003$; and the flatness test (main effect for time) was significant, $F(7, 52) = 492.88$, $p < .001$. The strength of association for the interaction effect was $\eta^2 = 0.28$. The correlations between the subtests were low to moderate (.07–.59). To better understand the statistically significant between-group effects, we again conducted a stepdown analysis using Roy-Bargmann stepdown *F* tests. We prioritized the subtests on the basis of hypotheses regarding what skills were most likely to have been affected by the intervention (Tabachnick & Fidell, 2006): Problem Identification, Resolution 1, Resolution 2, Reliance on Others, Support–Other, Support–Child, and Limit Setting. Table 4 presents the cell means for the groups at the two times of measurement and the corresponding stepdown *F*s. Because there are seven subtests in this measure, accrual of α was limited by dividing .05 by 7, with the resultant α of .007. The stepdown *F*s for Resolution 1 did reach significance using this adjusted α level, meaning that the significant effect seen between the groups is best understood as a result of the treatment group children not relying on easy or unrealistic solutions to problems.

Discussion

This study examined the effectiveness of a group therapy curriculum designed to address the neurocognitive difficulties commonly experienced by children with FAS and ARND, including deficits in executive and emotional functioning marked by difficulties in self-regulation, emotional control, planning, and organization. As hypothesized, children in the intervention group demonstrated significant improvements in executive and emotional functioning when compared with the control group. This change was documented using the BRIEF, a parent report measure of executive functioning, and the RATC, a measure of emotional problem solving. Both the parent and the child interventions

Table 3. Mean BRIEF Scores at Baseline and Follow-Up, by Group

		Baseline		Follow-Up			
Subtest	Group	*M*	*SD*	*M*	*SD*	Roy-Bargmann Stepdown *F (df)*	*p*
Inhibit	Treatment	67.82	9.27	68.29	10.95	1.13 (1, 63)	.29
	Control	67.50	9.58	65.25	10.68		
Shift	Treatment	68.06	12.06	68.85	13.42	0.98 (1, 61)	.32
	Control	62.81	9.84	64.22	12.21		
Emotional Control	Treatment	62.74	10.22	62.71	10.33	0.57 (1, 64)	.45
	Control	60.84	11.11	59.12	9.58		
Initiate	Treatment	61.00	12.24	60.21	11.93	1.57 (1, 60)	.22
	Control	63.91	8.61	63.91	8.61		
Working Memory	Treatment	68.15	9.42	67.62	9.11	0.001 (1, 58)	.97
	Control	67.00	9.73	66.41	8.87		
Plan/Organize	Treatment	64.50	12.59	66.71	10.80	3.43 (1, 59)	.07
	Control	68.69	9.41	69.09	9.35		
Organization of Materials[a]	Treatment	3.58	1.41	3.17	1.58	7.77 (1, 57)	.007
	Control	3.06	1.38	3.25	1.23		
Monitor	Treatment	67.03	7.00	63.12	10.48	7.02 (1, 62)	.01
	Control	64.56	10.08	64.38	7.35		

Note. BRIEF = Behavior Rating Inventory of Executive Function; *M* = mean; *SD* = standard deviation.
[a]Transformed by reflection and square root because of excessive skewness on the scale.

Table 4. Mean RATC Scores at Baseline and Follow-up, by Group

Subtest	Group	Baseline *M*	Baseline *SD*	Follow-Up *M*	Follow-Up *SD*	Roy-Bargmann Stepdown *F (df)*	*p*
Reliance on Others	Treatment	49.79	11.61	46.59	14.80	0.32 (1, 55)	.57
	Control	52.77	18.48	53.03	14.68		
Support–Other[a]	Treatment	6.11	0.88	1.50	0.13	0.43 (1, 54)	.52
	Control	6.02	0.91	1.56	0.13		
Support–Child[a]	Treatment	0.02	0.00	0.02	0.00	0.29 (1, 53)	.59
	Control	0.02	0.00	0.02	0.00		
Limit Setting	Treatment	57.38	13.53	58.59	15.48	0.12 (1, 52)	.73
	Control	57.19	12.98	58.16	16.67		
Problem Identification	Treatment	55.93	18.19	55.76	20.15	0.47 (1, 58)	.50
	Control	60.00	17.14	56.06	16.32		
Resolution 1[a]	Treatment	1.66	0.10	6.76	0.91	14.45 (1, 57)	.00
	Control	1.72	0.11	7.70	0.92		
Resolution 2[a]	Treatment	6.88	0.83	6.51	0.93	4.43 (1, 56)	.04
	Control	6.31	0.86	6.23	0.94		

Note. *M* = mean; RATC = Roberts Apperception Test for Children; *SD* = standard deviation.
[a]Transformed by square root because of excessive skewness on the scale.

addressed multiple complex areas of executive and emotional functioning rather than targeting one specific area.

Unlike clinical testing situations, the settings in which children are most commonly involved (home and school) are environments with multiple stimuli and shifting expectations. Because these settings are complex, children with prenatal alcohol exposure may be unable to use what executive functioning skills they do have and may become progressively more dysregulated as they are distracted or overwhelmed by stimulation in their environment. Using the engine speed analogy from the Alert Program, a critical aspect of the neurocognitive habilitation program involved teaching the children to learn to identify internal indicators of dysregulation and to use new strategies to improve their self-regulation and emotional control within the context of a group setting. In addition, the combined parent–child segment at the end of each session provided further opportunity to master new skills in another context with support by parents, who were then able to reinforce the new skills in the home environment. The behavioral changes the parents observed in real-world situations were most likely attributable to a combination of factors, including the opportunity the group offered the children to learn and apply their skills in a socially interactive, dynamic setting and the knowledge and skills the parents gained during the psychoeducation group.

A limitation of this study is that the results cannot be generalized to all school-age children with prenatal alcohol exposure because the study participants resided in foster or adoptive homes. It may be that biological parents would respond differently to the parent curriculum. In addition, although the BRIEF indicated significant improvement in executive functioning on the basis of parent report, future studies are needed to assess executive functioning in multiple settings, such as at school. A further limitation of the study was that the differences in outcomes between the treatment and control groups may have been muted by the extensive feedback and comprehensive recommendations the assessment psychologist provided following the initial screening to both treatment and control group parents regarding their child's behavior, learning, and emotional functioning. Thus, although the control group did not participate in the neurocognitive habilitation program, they potentially derived benefits from this initial evaluation and feedback.

Implications for Research, Policy, and Practice

Research indicates that several childhood disorders are linked to delays or deficits in executive functioning (Emerson, Mollet, & Harrison, 2005; McCandless & O'Laughlin, 2007). Deficits in the executive functions of inhibition, planning, organization, and sustained attention likely contribute to the prevalence of ADHD in children with prenatal alcohol exposure (Brown et al., 1991; Nanson & Hiscock, 1990). Most children (74%) in both groups had received a diagnosis of ADHD, making it the most common secondary disorder in our sample. Addressing deficits in executive functioning with the neurocognitive habilitation intervention may decrease ADHD symptoms in children with FAS and ARND who initially present with the ADHD diagnosis.

This study describes a clinical population that has been prenatally exposed to alcohol and may present to occupational therapists. It provides information about the sensory integration and executive functioning needs of children with prenatal alcohol exposure, and it explains how occupational therapists can adapt the Alert Program for children with fetal alcohol spectrum disorders. The findings from this study yield promising evidence of the effectiveness of the neurocognitive habilitation curriculum, adapted from the Alert Program, as an intervention to improve executive functioning deficits and emotional problem-solving skills in children with a diagnosis of FAS or ARND.

Our findings are an important step in the development of effective treatment interventions with this population. As our understanding of the challenges faced by children who are prenatally exposed to alcohol continues to expand, it will be equally important to maintain our focus on the creation and refinement of intervention programs that help affected children develop new skills and maximize existing strengths. ▲

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