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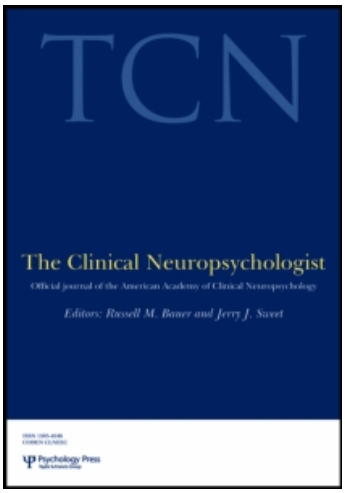

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Behavioral Regulation as a Predictor of Response to Children's Friendship Training in Children with Fetal Alcohol Spectrum Disorders

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BEHAVIORAL REGULATION AS A PREDICTOR OF RESPONSE TO CHILDREN'S FRIENDSHIP TRAINING IN CHILDREN WITH FETAL ALCOHOL SPECTRUM DISORDERS

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Children with fetal alcohol spectrum disorders (FASDs) evidence an array of structural brain abnormalities and neurocognitive deficits. Furthermore, previous research suggests that deficits in executive functioning (EF) may be associated with significant difficulties in the formation of positive peer relationships in this population. The purpose of the current study was to examine the role of EF as a predictor of treatment response to a controlled social skills intervention for children with FASDs. A total of 100 children between the ages of 6 and 12 received Children's Friendship Training (CFT). Prior to treatment, parents completed the* Behavior Rating Inventory of Executive Functioning *(BRIEF). Treatment outcome was measured using parent report on the* Social Skills Rating System *(SSRS). The results demonstrated that behavioral regulation as measured on the BRIEF predicted the effectiveness of CFT for children with FASDs, regardless of general intellectual functioning. Specifically, the ability to control impulses, solve problems flexibly, and monitor emotional responses significantly predicted improvement in social skills and reduction in problem behaviors following CFT.

Keywords: Fetal alcohol spectrum disorder; Friendship training; Social skills; FAS.

INTRODUCTION

Over the past 30 years, mounting evidence has prompted increased attention to the role of prenatal alcohol use in the occurrence of a wide range of developmental problems (Sokol, Delaney-Black, & Nordstrom, 2003). Adverse effects associated with prenatal alcohol exposure vary depending on the amount and pattern of alcohol consumed, and include teratogenic effects on the brain (Sokol et al., 2003). Fetal alcohol syndrome (FAS) is the most severe condition in the live offspring of women who used alcohol during pregnancy and is characterized by facial malformations, growth deficiencies, and central nervous

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system deficits (Jones & Smith, 1973). Although not all exposed individuals will meet criteria for FAS, many will have significant problems associated with alcohol exposure in utero (Stratton, Howe, & Battaglia, 1996). These individuals have been defined as having partial FAS (PFAS), alcohol-related neurodevelopmental disorders (ARND), or alcohol-related birth defects (ARBD) according to the Institute of Medicine's (IOM) suggested classification scheme (Stratton et al., 1996). The entire continuum of effects, encompassed under the rubric of fetal alcohol spectrum disorders (FASDs; Warren et al., 2004), is estimated to represent at least 1% of all live births (May & Gossage, 2001).

Research on structural brain changes in individuals with prenatal alcohol exposure using magnetic resonance imaging (MRI) has documented overall reductions in brain size and greater than expected reductions in the sizes of the basal ganglia, corpus callosum, and anterior cerebellar vermis (see Riley, McGee, & Sowell, 2004; Spadoni, McGee, Fryer, & Riley, 2007 for review). Reductions in the basal ganglia are greatest in the caudate and occur following heavy prenatal alcohol exposure, even without the facial dysmorphia associated with FAS. Similar results are reported for the cerebellum. Case reports utilizing MRI have replicated the finding of corpus callosum agenesis in individuals with fetal alcohol exposure (Johnson, Swayze, Sato, & Andreasen, 1996; Swayze et al., 1997). In fact, it has been proposed that prenatal alcohol exposure may be the most common cause of this anomaly (Jeret, Serur, Wisniewski, & Frisch, 1986). Most recently, advances in quantitative brain image analysis techniques have revealed abnormalities in the perisylvian cortices of the temporal and parietal lobes, particularly in the left hemisphere (Sowell et al., 2001). With regard to the importance of these structures for neurocognitive functioning, the caudate communicates with the dorsolateral prefrontal cortex and appears to be involved in cognition, particularly with executive functions (EF) (Cummings, 1993) whereas the cerebellum has been implicated in EF through connectivity with the frontal lobe (Schweizer et al., 2008). Impairments in planning, response inhibition, cognitive flexibility, verbal and nonverbal fluency, abstract reasoning, and problem solving are prominent in children with prenatal alcohol exposure (Kodituwakku, 2007; Kodituwakku, Kalberg, & May, 2001; Rasmussen, 2005; Rasmussen, Horne, & Witol, 2006). Frontal lobe deficits, particularly in the inferior parietal/perisylvian areas, may explain problems in response inhibition and poor behavioral regulation in alcohol-exposed children. They may also help to explain poor psychosocial functioning, social skills, and interpersonal relations following prenatal exposure to alcohol (McGee & Riley, 2006; Schonfeld, Paley, Frankel, & O'Connor, 2006; Thomas, Kelly, Mattson, & Riley, 1998; Whaley, O'Connor, & Gunderson, 2001). Both executive and social functioning deficits are correlated with indices of the metabolic composition of the medial temporal and frontal lobes (Nash et al., 2006a, 2006b). Importantly, when children exposed to alcohol prenatally have been compared to other developmentally disabled children who were equally microcephalic and functionally impaired, their respective brain abnormalities were shown to be different, both structurally and functionally (Riley et al., 2004). Taken together, these results suggest that there is a distinct pattern of brain damage that results from heavy prenatal alcohol exposure that may be distinguished from other neurodevelopmental disorders.

The neuropsychological literature highlights EF as a necessary component for social competence and studies of various populations of children with developmental problems have linked it to social abilities (McEvoy, Rogers, & Pennington, 1993; Warschausky, Giacoletti Argento, Hurvitz, & Berg, 2003). For example, a recent study demonstrated that in a group of adolescent boys with conduct disorder, impairments in decision making, anticipating consequences, delay of gratification, and impulsivity were predictive of poor outcome in social performance following intervention (Fishbein et al., 2005). In the only study to date that has examined the association between EF and social skills in younger children (aged 6 to 12 years) with prenatal exposure to alcohol it was found that EF, as rated by both parents and teachers, was highly predictive of child behavior (Schonfeld et al., 2006). In this study difficulty with regulation of behavior, as measured by the *Behavior Rating Inventory of Executive Functioning* (Gioia, Isquith, Guy, & Kenworthy, 2000), was found to be significantly associated with ratings of social skills and problem behaviors on the *Social Skills Rating System* (Gresham & Elliott, 1990). Specifically, in children with prenatal alcohol exposure, difficulty in shifting cognitive set and modulating emotions and behavior via appropriate inhibitory control was predictive of poorer social skills and more problem behaviors.

The findings reported above have implications for clinical interventions aimed at improving social competence in children with FASDs. The purpose of the current study was to examine the role of daily executive behaviors as a predictor of treatment response to a controlled social skills intervention for children with FASDs. Of interest was whether or not the child's ability to shift cognitive set, modulate emotions and behavior via appropriate inhibitory control (behavioral regulation), self-monitor behavior, and actively problem solve (metacognition) were related to treatment response. No previous studies have systematically implemented social skills training for children with FASDs and, to our knowledge, this is the first study of its kind to assess the relation between daily executive behaviors and treatment response in this population. The results of this study will be particularly relevant given the specific risk for delinquent behavior found in children with FASDs and the importance of early positive social relations in mitigating negative secondary outcomes (Schonfeld, Mattson, & Riley, 2005; Streissguth et al., 2004).

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METHOD

Participants

Participants were 100 children (51% male) between 6 and 12 years ($M = 8.59$; $SD = 1.56$) with prenatal alcohol exposure. All children had measurable social skills deficits (at least 1 standard deviation below the mean) on the Socialization domain of the *Vineland Adaptive Behavior Scales* (*VABS*; Sparrow, Balla, & Cicchetti, 1984), and a Vocabulary IQ of ≥ 70 ($M = 93.58$; $SD = 14.73$) on the *Kaufman Brief Intelligence Test* (Kaufman & Kaufman, 1990). Mean Composite IQ was 97.24 ($SD = 14.83$). Children were excluded from the study if they had medical conditions that might preclude study participation, major sensory or motor deficits, or a diagnosis of pervasive developmental disorder.

Table 1 Sample demographics

Variables	Total sample ($N = 100$)
Ethnicity (%)	
White, non hispanic	54.0
Black, non hispanic	17.0
Hispanic	17.0
Asian	2.0
Mixed	10.0
Child gender: males (%)	51.0
Child age in years (M, SD)	8.59 (1.56)
Child composite IQ (M, SD)[a]	97.24 (14.83)
Child verbal IQ[b]	93.58 (14.73)
Child socialization[c]	62.83 (8.04)
Biological mother (%)	21.0
Number of Placements (M, SD)	2.18 (0.20)
Primary caregiver married/partner (%)	62.0
Primary caregiver yrs education (M, SD)	16.28 (0.26)
FAS present (%)	11.0

[a]Kaufman Brief Intelligence Test Composite IQ.
[b]Kaufman Vocabulary Subtest.
[c]Vineland Socialization Standard Score.

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As seen in Table 1, the ethnic breakdown of the sample was 54% White Non-Hispanic, 17% Black Non-Hispanic, 17% Hispanic, and 12% other ethnicities. The majority of the children resided in adoptive or foster homes (79%) as opposed to biological homes (21%), although some adoptive families were biologically related (e.g., kinship care such as grandparents = 14%). The proportion of children in this sample living in adoptive or foster care is reasonably representative of the larger population of children with FASDs, as it has been estimated that approximately two-thirds of these children are raised outside their biological homes (National Organization for Fetal Alcohol Syndrome, 2006).

Children received a physical examination to assess for the presence of the diagnostic features of fetal alcohol spectrum disorders (FASDs) using the *Diagnostic Guide for Fetal Alcohol Spectrum Disorders* (Astley, 2004), which is described in more detail below. On the basis of the four-digit diagnostic system, 11% of children were diagnosed with FAS, 43% with partial FAS, and 46% with static encephalopathy which would be classified as having ARND according to guidelines developed by Dr. Astley (written communication, July 5, 2006) for converting the four-digit code to the diagnostic categories proposed by the Institute of Medicine (Stratton et al., 1996). This diagnosis is also consistent with the guidelines proposed by Chudley and colleagues (Chudley et al., 2005) for reconciling the IOM nomenclature and the four-digit code. No child met the IOM criteria for Alcohol Related Birth Defects (ARBD).

Procedures

All study-related activities took place at the University of California at Los Angeles, Semel Institute for Neuroscience and Human Behavior.

The University of California at Los Angeles and the Centers for Disease Control and Prevention Institutional Review Boards approved all procedures and a Certificate of Confidentiality was obtained from the NIAAA prior to participant recruitment. Informed consent was obtained from the parent (s) and assent from children $\geq$7 years of age.

Participants were recruited through various clinical and community contacts, including the UCLA Semel Institute for Neuroscience and Human Behavior and the UCLA Medical Center. Letters and fliers were mailed to local health care providers, schools, and non-clinical community contacts (e.g., YMCA). Interested participants contacted the project coordinator who conducted a screening interview by telephone to determine initial eligibility. If participants were eligible, baseline testing was scheduled prior to initiating the social skills intervention. Baseline measures included demographic information, IQ testing, the physical examination, and parent report of EF and social skills.

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Social skills treatment

The social skills treatment employed was Children's Friendship Training (CFT) developed by Frankel and Myatt (Frankel, 2005; Frankel & Myatt, 2003). CFT is a manualized, evidence-based social skills intervention that has been field-tested on over 1000 children in multiple clinical and research settings. This treatment has yielded significant social skills gains as reported by both teachers and parents at post-treatment and follow up for a large number of children from different outpatient clinical samples (Frankel, Myatt, & Cantwell, 1995; Frankel et al., 1997; Frankel, Myatt, & Feinberg, 2007; O'Connor et al., 2006). The development of CFT arose out of a need for more efficacious social skills treatment following findings of low effect sizes (Kavale, Mathur, Forness, Rutherford, & Quinn, 1997) and poor generalization from treatment settings (DuPaul & Eckert, 1994) in prior social skills interventions.

A central component of CFT is parental assistance to children in establishing social networks and in practicing newly learned skills outside of the treatment setting. The CFT was modified with specific treatment adaptations to account for the neurocognitive deficits common among children with FASDs. Modifications made primarily involved augmentation in how the treatment was delivered, rather than changes in the content or components of the intervention, thus preserving the basic integrity of the treatment (Laugeson et al., 2007). Skills taught included: (1) social network formation with the aid of the parent (Parke, Neville, Burks, Boyum, & Carson, 1994); (2) informational interchange with peers leading to a common-ground activity (Black & Hazen, 1990); (3) entry into a group of children already in play (Gelb & Jacobson, 1988); (4) in-home play dates (Frankel, 1996; Frankel & Myatt, 2003); and (5) conflict avoidance and negotiation (Rose & Asher, 1999). Table 2 provides an outline of the specific social skills that were taught in the intervention. These skills were taught in a small group setting through instruction on simple rules of social behavior; modeling, rehearsal, and performance feedback during treatment sessions; rehearsal at home; homework assignments; and coaching by parents during play between children.

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Table 2 Description of child and parent treatment sessions

Session	Topic child group	Goals child group	Topic parent group	Goals parent group
1	Rules of the group; elements of good communication	Children learn and practice elements of good communication by introducing themselves to one another	Goals and methods of treatment; limitations of intervention: what not to expect	Parents learn about importance of their role in the intervention; group leader reviews context and stability of sociometric categories
2	Having a conversation	Children learn how to exchange information, good and bad places to make friends	Having a conversation	Parents learn how to help their child develop two-way conversation skills, and how to better communicate with their child
3	Joining a group of children already at play: "slipping in"	Children learn when, where, and how to "slip in" or join a group of children already at play	Supporting child friendships	Parents learn about appropriate settings for play dates; sources of potential playmates; importance of adequate time availability for play dates
4	Joining a group of children already at play: "slipping in"	Children learn more techniques for group entry, reasons for rejection from group entry, and what to do in response to rejection	Joining a group of children already at play: "slipping in"	Parents learn when, where, and how their children should "slip in" to a group of children already at play, and importance of their child taking "no" for an answer
5	How to be a good sport	Children learn and practice basic rules of being a good sport	Joining a group of children already at play: "slipping in"	Parents learn how to help their child practice "slipping in" outside of the session
6	How to be a good sport	Children learn to praise other children, techniques of persuasion and negotiation. Children practice praising one another while playing games, and negotiating changes in games when they become bored	Appropriate games for play dates	Parents learn appropriate games and games to exclude for indoor and outdoor play

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7	Rules of being a good host	Children learn and practice rules of being the "host" during interactive indoor games	Play dates	Parents learn about sources for potential playmates for their child and physical resources for play dates. Parents learn about their responsibilities for the play date
8	How to handle teasing	Children learn and practice strategies for reacting neutrally or humorously to teasing, so as to reduce the likelihood of further teasing	How to handle teasing	Parents learn about effective strategies their child can use to handle teasing and are instructed on appropriate role play for practice
9	Unjustified accusations	Children learn how to handle situations when unjustly accused of bad behavior by an adult	How to handle other adults complaining about child's behavior	Parents learn how to respond appropriately and effectively to other adults who complain about their child's behavior so as to minimize their child getting a negative reputation
10	How to be a good winner	Children learn and practice rules of being a good winner	How to be a good winner	Parents learn rules of being a good winner and how to encourage their child's practice of those rules
11	Bullies and conflict situations	Children learn how to avoid conflict and have the opportunity to practice strategies for conflict resolution	Bullies and conflict situations	Parents learn how to support their child's use of strategies for defusing confrontations with another child
12	Graduation	Post treatment evaluation, graduation ceremony, and party for the children and their parents	Graduation	Parents complete post treatment evaluation and participate in the child's graduation ceremony and party

Children were assigned in groups of seven or eight to one of two conditions: CFT or Delayed Treatment Control (DTC). Children in the CFT group received 12 sessions, 90 minutes in length, delivered over the course of 12 weeks. Parents attended separate concurrent sessions in which they were instructed on advocacy issues related to FASD and on key social skills being taught to their children. Incentives included weekly pizza dinners, free baby-sitting for siblings, and $30 for completion of study assessments. Following a 12-week waiting period, children in the DTC group received treatment identical to the CFT group. For this study, data from children in both conditions following treatment were combined. Of the original 100 children, 96 completed treatment. Of the children who did not complete treatment, two did so because of family illness (CFT, $n = 1$; DTC, $n = 1$) and two were asked to leave the program because of excessive aggression that could not be safely monitored in the groups (CFT, $n = 1$; DTC, $n = 1$).

Postdoctoral fellows and child clinical psychology interns conducted the treatment. Fidelity checklists covering the primary content of the protocol were created for each treatment session. Undergraduate psychology students, trained to reliability, served as fidelity coders and coded all sessions live. If a group leader failed to cover any primary content, the coder reminded them during the sessions. Using this method, no substantial deviations from the treatment protocol were noted.

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Instruments

Eligibility measures

Demographic questionnaire. All parents completed a demographic questionnaire that included child gender, age, ethnicity, family living arrangement (biological/non-biological home), number of prior home placements, and maternal education.

Health Interview for Women. If they were available, biological mothers were administered the *Health Interview for Women* (O'Connor, Kogan, & Findlay, 2002). The interview yields standard alcohol measures of average number of drinks per drinking occasion, maximum drinks per occasion, and the frequency of both. One drink was considered to be 0.60 ounces of absolute alcohol. All alcohol levels obtained were considered estimates of actual exposure because they were based on maternal self-report. The criterion for alcohol exposure was ≥ 7 drinks within a 1-week period or ≥ 3 drinks on at least one drinking occasion. In a study by Barr and Streissguth (2001), a cut point of ≥ 7 drinks/week had 100% sensitivity and 83% specificity for diagnosis of FASDs. In other studies, a cut point of ≥ 2 drinks per drinking occasion has been a statistically significant predictor of behavioral teratogenesis associated with prenatal alcohol exposure (O'Connor, Sigman, & Kasari, 1993; Sood et al., 2001).

Review of medical records. For adoptive/foster children, medical, adoption, and/or legal records were obtained documenting known exposure. Examples of such documentation included medical records that indicated the biological mother was intoxicated at delivery, or adoption records indicating that the mother was

observed to drink heavily during pregnancy by a reliable collateral source. Detailed information regarding exact quantity and frequency of maternal alcohol use was not always available from the records, but provided sufficient information regarding maternal drinking during pregnancy. Because many children with prenatal alcohol exposure are either adopted or in foster care, it is often necessary to rely on such records to assess the child's history of exposure, and is accepted practice in the scientific community when making a diagnosis of FAS or a related condition (Centers for Disease Control and Prevention, 2004).

FASD diagnosis. Children received a physical examination to assess for the presence of the diagnostic features of fetal alcohol spectrum disorders (FASD) using the *Diagnostic Guide for Fetal Alcohol Spectrum Disorders* (Astley, 2004). This system uses a four-digit diagnostic code reflecting the magnitude of expression of four key diagnostic features of prenatal alcohol exposure: (1) growth deficiency; (2) the FAS facial phenotype, including short palpebral fissures, flat philtrum, and thin upper lip; (3) CNS dysfunction; and (4) gestational alcohol exposure. Using the four-digit diagnostic code, the magnitude of expression of each feature was ranked independently on a 4-point scale with 1 reflecting complete absence of the FAS feature and 4 reflecting the full manifestation of the feature. The study physician administered this examination after achieving reliability with the lead investigator who was trained by Dr. Astley.

Kaufman Brief Intelligence Test (K-BIT). The *K-BIT* is a brief, individually administered measure of verbal and nonverbal intelligence (Kaufman & Kaufman, 1990) composed of two subtests: Vocabulary and Matrices. The Vocabulary subtest was used as an eligibility criterion to ensure that study participants could understand the verbal components of the treatment. The split-half reliability coefficients for the Vocabulary IQ score for children aged 6 to 12 years averages 0.91 with test–retest reliability of 0.86 and construct validity with the *WISC-R* of 0.78.

Vineland Adaptive Behavior Scales, Interview Edition, Survey Form (VABS). The *VABS* is an interview designed to elicit a parent's assessment of their child's adaptive functioning in four domains: communication, daily living (self help), social, and motor skills (Sparrow et al., 1984). Standard scores ($M = 100$; $SD = 15$) are derived for each of these domains, as well as for an Adaptive Behavior Composite, which reflects functioning across all domains. The child's Socialization standard score was used as an index of their general level of adaptive functioning. The Socialization scale demonstrates good internal consistency (split-half reliability 0.78–0.94), test–retest (0.98), and inter-rater reliability (0.96). Higher scores on the Socialization Scale indicate better adaptive functioning. The sample mean Socialization standard score was 62.83 ($SD = 8.04$).

EF predictor measure

The Behavior Rating Inventory of Executive Functioning (BRIEF). The *BRIEF* is a parent report measure of the child's executive functioning standardized for children ages 5–18 (Gioia et al., 2000) This scale reports high internal consistency (Cronbach's alpha = 0.80–0.98) and test–retest reliability for normative

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(0.81) and clinical (0.79) samples. Convergent validity has been established with other measures of inattention, impulsivity, and learning skills and divergent validity has been demonstrated against measures of emotional and behavioral functioning. There are eight clinical subscales that comprise two indices: the Behavioral Regulation Index (BRI) and the Metacognition Index (MI). The BRI includes subscales of Inhibit (controls impulses), Shift (transitions and solves problems flexibly and as appropriate for a situation), and Emotional Control (monitors emotional responses appropriately). The MI includes Initiate (begins tasks independently), Working Memory (maintains information in mind during tasks in order to complete task), Plan/Organize (plans behavior to reach future goals and carries out steps in a systematic manner), Organization of Materials (keeps possessions and work/play spaces orderly), and Monitor (self-monitors work or behavior during and after tasks). The instrument is scaled using T-Scores of which a 65 (1.5 *SD* above the mean) or higher is considered clinically significant (higher scores indicate poorer executive functioning). Only the two major indices BRI and MI were used as predictor variables in the proposed models.

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Outcome measure

Social Skills Rating System (SSRS; Gresham & Elliott, 1990). Social skills were evaluated with the *Social Skills Rating System*, Parent Form at pre-treatment baseline and at post-treatment. The *SSRS* measures a child's competence with respect to social skills, and also the extent to which problem behaviors of clinical significance are present. Two main scales comprise the *SSRS*: Social Skills and Problem Behaviors, presented as standard scores ($M = 100$; $SD = 15$). The Social Skills scale measures cooperation, assertion, responsibility, and self-control. Lower scores represent poorer social functioning. The Problem Behaviors scale measures internalizing, externalizing, and hyperactivity. Higher scores represent greater problem behaviors. The *SSRS* has high criterion related validity, correlating significantly with other established measures of child social and problem behaviors (Gresham & Elliott, 1990), high internal consistency (Cronbach's alpha = 0.87–0.94) and test–retest reliability for parent ratings (0.65 and 0.87). Although some studies have called for a revised version of the *SSRS-P* consisting of fewer factors (Van Der Oord et al., 2005; Whiteside, McCarthy, & Miller, 2007), internal consistencies for cooperation, assertion, and self-control are acceptable (0.72–0.82) (Van der Oord et al., 2005). Further, the *SSRS-P* has been shown to accurately discriminate between children with and without a history of social problems (Whiteside et al., 2007) and between normal controls and an ADHD clinical sample (Van der Oord et al., 2005).

Statistical analysis

Tests for potential covariates. When assessing possible associations between executive functioning and social skills treatment response, it is important to consider that these relations could be attributed to other factors. Before model testing, possible covariates (child age, gender, Vocabulary IQ, ethnicity, number of previous home placements, years of maternal education, and FAS diagnosis) were

selected for analyses based on literature suggesting that they might be associated with social skills treatment outcome. Zero-order correlations revealed no statistically significant relations between these variables and the parent ratings on the *SSRS-P* post-treatment Social Skill or Problem Behavior scales ($ps > .05$) so they were not included in model testing.

Regression models. Four models were tested in this study. (1) Post-treatment *SSRS* Social Skills scores regressed on *BRIEF* BRI; (2) post-treatment *SSRS* Problem Behaviors scores regressed on *BRIEF* BRI; (3) post-treatment *SSRS* Social Skills scores regressed on *BRIEF* MI; and (4) post-treatment *SSRS* Problem Behaviors scores regressed on *BRIEF* MI. In all analyses, baseline measures of *SSRS* Social Skills or Problem Behaviors prior to treatment were included in the models to control for initial levels effects. Independent variables were entered simultaneously for each regression model. The statistical significance of each model, R^2, and standardized beta coefficients were calculated.

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RESULTS

Model testing behavioral regulation and response to CFT

The overall model testing the association between social skills treatment response and BRI was significant, $F(2, 92) = 11.63$; $p < .001$, $R^2 = .20$. Analysis revealed that BRI was a significant predictor of social skills outcome ($p < .05$) after controlling for initial levels. According to parent report, higher levels of child self-regulation resulted in more improvement in social skills functioning following CFT (Table 3). Similarly, the model examining the relation of BRI to problem behavior treatment outcome was significant, $F(2, 92) = 51.46$; $p < .001$, $R^2 = .53$. After controlling for initial levels, analysis revealed that BRI was a marginally significant predictor of a decrease in problem behaviors ($p = .057$) following CFT (Table 3).

Model testing metacognition and response to CFT

Results of model testing revealed that metacognition, as measured by the *BRIEF* MI scale, was not related to an improvement in social skills or to a decrease in problem behaviors following CFT (Table 3).

Clinical significance

In order to examine the clinical significance of study findings, analyses were conducted dividing groups into those children with and without clinically significant Behavioral Regulation (BRI) scores on the *BRIEF*. Children were divided into those with a BRI score of ≥ 65 (1.5 *SD* above the mean; $M = 50$, $SD = 10$), defined as the clinical group, and those with BRI scores < 65, defined as the non-clinical group. Two repeated measures ANOVAs examining BRI $\times$ Time (pre-treatment and post-treatment) were conducted with parent ratings of Social Skills or Problem Behaviors on the *SSRS* as the dependent variables. Results revealed that while both groups showed improvement in their social skills and a decrease in their problem

Table 3 Prediction of response to children's friendship training

	F	β	*B* (*SE*)	R^2 (*Adjusted* R^2)
SSRS-Social Skills	11.63***			0.20 (0.18)
Baseline Social Skills		0.31**	0.35 (0.12)	
BRIEF BRI		−0.21*	−0.25 (0.13)	
SSRS-Problem Behaviors	51.46***			0.53 (0.52)
Baseline Problem Behaviors		0.59***	0.60 (0.10)	
BRIEF BRI		0.18^{+}	0.21 (0.11)	
SSRS-Social Skills	9.97***			0.18 (0.16)
Baseline Social Skills		0.38***	0.42 (0.11)	
BRIEF MI		−0.11	−0.16 (0.14)	
SSRS-Problem Behaviors	47.73***			0.51 (0.50)
Baseline Problem Behaviors		0.71***	0.72 (0.08)	
BRIEF MI		0.02	0.03 (0.12)	

SSRS = Social Skills Rating System; BRIEF = Behavior Rating Inventory of Executive Functioning; BRI = Behavior Regulation Index; MI = Metacognition Index.

***$p < .01$; **$p < .01$; *$p < .05$; $^{+}p = .05$.

behaviors following treatment (pre-treatment to post-treatment, $F(1, 93) = 20.45$, $p < .0001$ and $F(1, 93) = 15.08$, $p < .0001$, Social Skills and Problem Behaviors, respectively), for those with non-clinical BRI scores (<65), *SSRS* post-treatment Social Skills and Problem Behavior scores moved into the average range based on normative sample statistics ($M = 100$; $SD = 15$). Children with non-clinical BRI scores received an average Social Skills score of 86.66 ($SE = 2.03$) post treatment. In contrast, those with clinically elevated BRI scores achieved a *SSRS* Social Skills average score of 77.6 ($SE = 1.45$), post-treatment, $F(1, 93) = 13.04$; $p < .0001$. For *SSRS* Problem Behaviors, the average scores were 109.45 ($SE = 1.97$) and 125.11 ($SE = 1.40$) for the non-clinical and clinical BRI groups, respectively, $F(1, 93) = 41.94$; $p < .0001$.

DISCUSSION

Studies reveal that problems in EF are highly prevalent in children with FASDs and that these problems are associated with social skills deficits in this population (Rasmussen, 2005; Schonfeld et al., 2006). In this study we demonstrated that behavioral regulation deficits predicted the effectiveness of social skills training for children with FASDs, regardless of general intellectual functioning. Specifically, the ability to control impulses, solve problems flexibly, and monitor emotional responses significantly predicted children's improvement in social skills and a marginal reduction in problem behaviors following CFT. Children scoring in the non-clinical range on the *BRIEF* BRI were able to achieve normative functioning with regard to their social skills and problematic behaviors following treatment. While some improvement was seen in children with poor behavioral regulation following treatment, this improvement did not result in normative functioning.

The ability to regulate one's own behavior and emotions is considered a frontal systems function involving interconnections between the cortical and

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subcortical regions of the brain. Behavioral regulation involves the ability to inhibit inappropriate behavior, anticipate consequences of actions, and an awareness of how one's behavior affects others (Lezak, 2004). These are all areas of behavioral functioning that have been documented as deficient in children with FASDs and have been associated with structural abnormalities in the brain following alcohol exposure in utero (Carmichael Olson, Feldman, Streissguth, Sampson, & Bookstein, 1998a; Carmichael Olson, Morse, & Huffine, 1998b; Kodituwakku, 2007; McGee & Riley, 2006; Rasmussen, 2005; Spadoni et al., 2007). Further, behavioral regulation is highly related to social competence. Poor emotional and behavioral regulation has been shown to be predictive of rejection, socially inappropriate behavior, and high rates of problem behaviors in third graders as rated by peers, teachers, and parents (Eisenberg, Pidada, & Liew, 2001). In addition, poor behavioral regulation is predictive of future social difficulties and poor peer status in very young children. Clearly, without these self-regulatory skills, social abilities are negatively affected and can help to explain why children with FASDs are more likely to have social deficits, such as poor-quality relationships and high rates of peer rejection (Thomas et al., 1998; Whaley et al., 2001). Importantly, inappropriate social behavior and few friendships put children at risk for delinquency (Kupersmidt, Coie, & Dodge, 1990) and problems with the law, secondary deficits that are prevalent in this population (Schonfeld et al., 2005; Streissguth et al., 2004).

Metacognition was unrelated to treatment response. In this study metacognition was defined as the child's ability to initiate activities, as well as to monitor behavior and to remember important tasks related to social interactions. It is possible that the inclusion of parents as monitors of their children's social encounters in this treatment decreased the need for the children to perform these tasks themselves. Various simple mnemonics were provided to parents to assist them in coaching their children at home. This strategy likely decreased demand on the children's memory so it is possible that the impact of factors related to MI was minimized. Alternatively, metacognition is less developed in young children, and thus might be less important at an early age for attaining social competence than the ability to modulate emotions and behavior using appropriate inhibitory control and flexibility in problem solving.

Some limitations emerge from this investigation. First, although not ideal, it is common in the literature on prenatal alcohol exposure to utilize retrospective accounts of alcohol exposure from the biological mother and/or to rely on records or collateral reports for this information, as was necessary for this study. However, previous research suggests that reasonably valid measures of prenatal drinking can be obtained post-natally (Ernhardt, Morrow-Tlucak, & Sokol, 1988; O'Connor & Paley, 2005). Second, children with mental retardation were not included in this study because CFT was designed for children without substantial cognitive delays. As this limits the representation of prenatally exposed children in the sample, it is possible that as child IQ decreases into the range of mental retardation, ratings of EF and social skills would be more dependent on general intellectual functioning than was found in this study. Third, parent ratings were used for both the executive function predictor measures and the response to social skills treatment outcomes. Although the use of the same reporter for both measures may result in response bias, parents did not uniformly report both domains of EF as predictive of response

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to social skills training. Specifically, parents endorsed behavioral regulation, but not metacognition, as predictive of response to treatment. Fourth, direct laboratory measures corresponding to behaviors associated with EF and domains of the *BRIEF* were not obtained for the children in this sample. The *BRIEF* is but one parent report measure of daily functioning in executive domains. Ideally, both a report of functional executive skills plus measures obtained from direct observation of child behavior would be optimal.

In summary, children's abilities to control impulses, readily transition, and solve problems in a flexible manner predicted parent reports of improvement in social skills and marginally significant decreases in problematic behaviors as a result of CFT. The results of this study suggest that the behavioral regulation aspect of executive functioning is related to change in social competence outcomes following treatment and that deficits in EF must be considered when designing any treatment procedure for children with FASDs. For example, some of the strategies used in this intervention to facilitate learning in children with prenatal alcohol exposure included increased use of verbal prompts, modeling, role playing, regular review of clear and explicit rules, and homework rehearsal (Laugeson et al., 2007). This study supports the importance of considering the neurocognitive limitations of children with prenatal alcohol exposure when designing treatment programs and the notion that children with this developmental disability can benefit from specifically tailored interventions.

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