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INTERVENTION FOR INDIVIDUALS WITH FETAL ALCOHOL SPECTRUM DISORDERS: TREATMENT APPROACHES AND CASE MANAGEMENT

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Exposure to alcohol in utero is considered to be the leading cause of developmental disabilities of known etiology. The most severe consequence of such exposure, fetal alcohol syndrome (FAS), is characterized by a distinct constellation of characteristic facial anomalies, growth retardation, and central nervous system (CNS) dysfunction. Some individuals with prenatal alcohol exposure (PAE) do not meet the full criteria for FAS, but instead are diagnosed with partial FAS, alcohol related neurodevelopmental disorder (ARND), or alcohol related birth defects (ARBD). The entire continuum of effects from PAE is increasingly being referred to under the umbrella term of fetal alcohol spectrum disorders (FASDs). An extensive body of research has documented major cognitive, behavioral, adaptive, social, and emotional impairments among individuals with FASDs. Although FAS was identified in the U.S. over 35 years ago, the development, evaluation, and dissemination of evidence-based interventions for individuals with FASDs have lagged behind significantly. Encouragingly, however, in recent years there has been a marked increase in efforts to design and test interventions to remediate the impairments associated with prenatal alcohol exposure. This article will review treatment needs and considerations for individuals with FASDs and their families, current empirically tested treatment approaches, case management issues, and suggestions for future directions in research on the treatment of FASDs.
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Key Words: fetal alcohol syndrome; fetal alcohol spectrum disorders; intervention; treatment; case management

Exposure to alcohol in utero is considered to be the leading cause of developmental disabilities of known etiology. The most severe consequence of such exposure, fetal alcohol syndrome (FAS), is characterized by a distinct constellation of characteristic facial anomalies, growth retardation, and central nervous system dysfunction. Some individuals with prenatal alcohol exposure (PAE) do not exhibit all the diagnostic features of FAS, but instead are diagnosed with partial FAS, alcohol related neurodevelopmental disorder (ARND), or alcohol related birth defects (ARBD). The entire continuum of effects from PAE is increasingly being referred to under the umbrella term of fetal alcohol spectrum disorders [FASDs; Warren et al., 2004]. An extensive body of research has documented major cognitive, behavioral, adaptive, social, and emotional impairments among individuals with FAS, including intellectual and learning disabilities, deficits in executive functioning, memory problems, speech and language delays, inattention, hyperactivity, internalizing and externalizing behavior problems, and social impairments [Burd et al., 2003; Streissguth et al., 2004; Rasmussen, 2005; Kodituwakku, 2007; Streissguth, 2007; Guerri et al., 2009]. Such deficits have also been reported among those with other diagnoses under the umbrella of FASDs [Mattson et al., 1998; Kvigne et al., 2004; Schonfeld et al., 2005; McGee and Riley, 2007]. The most recent prevalence estimates of FAS are at least two to five per 1,000, with the prevalence of the entire continuum of FASDs estimated to be 2–4% [May et al., 2009]. The cost of FAS in the United States is estimated to be over four billion dollars per year [Harwood, 1998]. Although the costs for all FASDs are unknown, they are expected to be considerably higher [Lupton et al., 2004].

In addition to a multitude of primary deficits, individuals affected by PAE also frequently struggle with numerous and severe secondary disabilities. Such individuals are at a significantly increased risk for mental health problems and psychiatric confinement, school failure, alcohol and substance abuse problems, and delinquency and incarceration [Streissguth et al., 2004]. Researchers and clinicians have recognized the critical need for early diagnosis and intervention to prevent the emergence of these deleterious outcomes. This article will review treatment needs and considerations for individuals with FASDs and their families, empirically tested treatment approaches, case management issues, and suggestions for future directions in research on the treatment of FASDs.

Treatment Needs and Consideration

Although the recognition that an individual has a history of PAE can alert clinicians to a range of potential treatment

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needs, it is important to keep in mind that there is considerable variability in both the manner and the extent to which the effects of PAE are manifested. Indeed, Hannigan and Berman [2000] have remarked that a diagnosis of FAS or ARND in and of itself does not provide sufficient information to direct practitioners towards appropriate treatments. Rather, specific deficits must be identified in order for a clinician to "pull out from her or his armatorium the correct 'bullet' for that problem, aim, shoot, and move on to the next problem needing treatment" (p 104). Furthermore, there may also be variability across different domains of functioning within the same individual. That is, an alcohol-exposed individual may exhibit significant deficits in some areas of functioning, while also showing strengths in other areas. Such observations highlight the need for thorough assessments that are designed to evaluate functioning across multiple domains [Paley and O'Connor, 2007] to inform and guide the development of specifically tailored interventions for affected individuals.

Researchers and clinicians have also underscored the importance of intervening with the entire spectrum of alcohol-exposed individuals. Two factors that have been identified as increasing the risk for negative outcomes include having an intelligence quotient (IQ) $\geq$ 70 and being diagnosed with an alcohol-related disorder other than FAS. In work by Streissguth et al. [2004], individuals who did not meet the full criteria for FAS but instead were diagnosed with fetal alcohol effects and/or those with IQs above 70 were at highest risk for delinquency, school failure, and alcohol and drug abuse problems. Such findings may seem surprising, but this pattern may occur because these individuals are less readily identified as needing services, and are less likely to qualify for and receive services than either individuals who meet full criteria for FAS or those with IQs below 70. It is also possible that individuals with lower levels of intellectual functioning are monitored more closely by their parents or caregivers, thus allowing them fewer opportunities to engage in high-risk behavior. These findings highlight the importance of intervention efforts that are targeted at the full spectrum of disorders, so that prenatally exposed individuals at the greatest risk do not fall through the cracks.

The consequences of FASDs reverberate well beyond those experienced directly by the alcohol-exposed individuals. Studies have documented the high levels of stress experienced by both biological and foster/adoptive of children with FASDs, and such stress seems to be partly related to the extent of the child's impairments [Paley et al., 2005, 2006]. In a recent study [Brown et al., 2004], foster parents of children with FASDs noted the need for social, instrumental, and professional support and services, and an understanding of FASDs, including knowledge and skills related to behavioral management and parenting children with disabilities. Biological mothers (and fathers as well) of alcohol-exposed children may be contending with ongoing substance abuse problems and may also feel stigmatized [Salmon, 2008], particularly if others are aware of the child's disability. Providers should also be aware that multiple generations within the same family can be affected by prenatal alcohol exposure. Parents or caregivers who themselves are affected by PAE may be less effective advocates for their child, and may also need their own contingency of services. Thus, the most effective interventions may be those that not only aim to lessen the myriad of cognitive, social, and behavioral difficulties often exhibited by individuals with PAE, but also those that focus on providing resources, education, training, and direct services (when needed) to caregivers to maximize their adjustment and functioning as well.

Indeed, a key element of working with individuals with FASDs must consist of providing education to parents and caregivers regarding the nature of their child's disability, including the ways in which their deficits will manifest in their daily lives, appropriate goals for intervention, and how to effectively advocate for services. Such education may have a multitude of benefits. Because FASDs are not always well-understood by family members, behavior problems may sometimes be viewed as reflective of poor motivation, an absence of empathy, or as willful defiance rather than as a function of the individual's neurocognitive impairments [Green, 2007; Olson et al., 2007; Scott and Dewane, 2007]. Clarifying for parents or caregivers that such behaviors are often secondary to alcohol-related brain damage may help them respond to their children in a more supportive and patient manner. In turn, parents and caregivers may need to play an important role in educating medical, mental health, and educational professionals who are working with their child. Education about the features of children with PAE is important because many professionals may lack training in identifying and treating alcohol-exposed children and may not fully understand the extent and nature of the child's impairments [FASD Regional Training Centers Consortium, 2007; Paley et al., 2009].

Interventions for FASDs

Although FAS was identified in the U.S. over 35 years ago [Jones and Smith, 1973], the development, evaluation, and dissemination of evidence-based interventions for alcohol-exposed individuals have lagged behind significantly. A review by Premji et al. [2006] highlighted the paucity of research-based interventions for this population, and further noted that the few extant studies were characterized by small sample sizes and methodological limitations. Burd [2006] similarly lamented the lack of quality diagnostic and treatment services available to alcohol-exposed children and their families, and emphasized the need for interventions that are aimed at reducing the secondary disabilities commonly associated with FASDs (e.g., mental illness, substance abuse). Encouragingly, however, in recent years there has been an increase in efforts to design and test interventions to remediate the impairments associated with PAE.

Animal Studies

Animal research can provide valuable insights as to potentially fruitful directions for intervention, and a number of studies have examined the effects of neonatal handling, postnatal environment enrichment, and rehabilitative training on rats and mice with perinatal alcohol exposure [see Hannigan et al., 2007; Kelly et al., 2009]. Research on neonatal handling has yielded mixed findings. Lee and Rabe [1999] found neonatal handling eliminated alcohol-induced spatial learning deficits on a T-maze reversal task, whereas Gabriel et al., [2002] found no such benefits for spatial learning in the Morris maze. Other animal studies have demonstrated that providing an enriching environment postnatally can improve outcomes in a variety of domains. Hannigan et al. [1993] were able to ameliorate motor and spatial impairments in alcohol-exposed rat pups by providing them with various objects to play with and manipulate and housing them with other rat pups. Thomas et al., [2008]

found that opportunities for voluntary exercise improved spatial memory among alcohol-exposed rats. Research on rehabilitative training, which involves forced learning of complex motor skills, has also yielded some promising results. In their research, Klintsova, Goodlett and Greenough [as cited in Guerri et al. 2005] demonstrated that introducing complex motor training during the postnatal period effectively remediated the motor deficits of alcohol-exposed rats. The findings from these animal studies are promising in that they suggest that it may be possible to partially remediate some of the deficits associated with alcohol-induced brain damage. However, the task of intervening with human beings affected by PAE is undoubtedly far more complex and requires a broad continuum of services and support.

Educational and Cognitive Interventions

The multitude of cognitive, executive functioning, and behavioral impairments experienced by individuals with FASDs present major obstacles to their ability to learn and succeed academically. Children with FASDs show deficits in language comprehension, reading, spelling, and math [Mattson et al., 1998; Duquette and Stodel, 2005] and are at increased risk for learning disabilities [Burd et al., 2003] as well as problematic classroom behaviors [Carmichael Olson et al., 1992].

Teaching strategies

An emphasis on certain teaching strategies may help facilitate learning in individuals with FASDs [Watson and Westby, 2003; Green, 2007; Kalberg and Buckley, 2007; Laugeson et al., 2007]. Examples of such teaching strategies include (1) implementing consistent and predictable routines, such as scheduling activities or tasks in the same order every day; (2) providing numerous opportunities for behavioral rehearsal and practice, since children with FASDs require much more practice to acquire a skill than nonexposed children; (3) making contingencies explicit (e.g., if you do X, then Y will happen), which may help compensate for the difficulties these children have understanding cause and effect relationships and anticipating consequences of behavior; (4) breaking down verbal instructions into small steps to address receptive language problems and executive functioning impairments and aid in comprehension and performance of multistep tasks; and (5) using visual cues and aids to accompany verbal instructions.

Classroom modifications

In describing interventions for children with FASDs, Kalberg and Buckley [2007] have noted, "it is helpful to think of the environment as an external nervous system of the child, a place where external (environmental) supports can be implemented to bolster the deficit areas of the child" (p 282). Green [2007] has similarly emphasized the importance of classroom environments that facilitate children's ability to regulate their behaviors and emotions and the need for teachers and parents to be attentive to aspects of the child's environment that may interfere with their ability to learn. Aspects of the classroom environment that may facilitate learning in individuals with FASDs include minimal visual and auditory distractions, clearly designated activity centers, use of daily schedules that are easily visible, clearly organized materials, and visual highlighting of important aspects of a task or activity [Kalberg and Buckley, 2007].

Support and resources for teachers

Providing educational resources for teachers is important, as students with FASDs can be quite challenging for teachers, thus requiring a disproportionate amount of teachers' attention and resources. Some teachers may feel unprepared to work with this population and less experienced teachers may find it challenging to modify their instruction to accommodate the cognitive and behavioral deficits commonly observed in students with FASDs [Ryan and Ferguson, 2006]. There are a number of handouts and guides available for teachers that provide suggestions for working with students with FASDs (e.g., http://www.nofas.org/educator/teaching.aspx). However, it is also important to recognize that teachers must contend with multiple demands on their time and attention, and they may not be always able to provide optimally individualized instruction for an alcohol-exposed student. Thus, parents and caregivers may also need to advocate for their child to receive other support both within the classroom (e.g., an aide, testing accommodations) and outside of it (e.g., after-school tutoring, speech, and language therapy, etc.).

Cognitive and academic skills training

Watson and Westby [2003] have recommended a number of cognitive and academic interventions for this population, based on Barkley's recommendations for students with attention deficit/hyperactivity disorder (ADHD) [Barkley, 1998], including visualization training, language interventions, self-regulation training, and interventions aimed at enhancing problem-solving skills. However, parents often have difficulty obtaining services that are specifically designed to address the learning deficits that are frequently observed in children with FASDs. A few recent studies, however, have examined the efficacy of various interventions aimed at improving the cognitive and educational functioning of children with PAE. Some studies have focused on enhancing general learning skills, whereas others have targeted specific cognitive or academic domains.

In a pilot study, Adnams et al., [cited in Riley et al. 2003] provided cognitive control therapy (CCT) to a small group of school-aged children with FAS. CCT aims to teach children strategies that facilitate their ability to acquire and organize information more effectively. Compared to a control group, children who received CCT, 1 hr weekly for 10 months, demonstrated improvements in classroom behavior. The intervention group also showed qualitative improvements in academic achievement, and writing and communication skills as reported by teachers, and improvements in self-efficacy, motivation, self-confidence, and emotionality as reported by therapists. However, the CCT and the control group did not differ significantly from one another on cognitive control and neuropsychological batteries. In another study targeted at improving a broad set of cognitive skills, Chasnoff et al. evaluated the efficacy of a program designed to enhance self-regulation skills and remediate executive functioning deficits in a sample of school-aged children in foster care who had been diagnosed with FAS or ARND. Results indicated a significant treatment effect on a parent report measure of executive functioning [Chasnoff et al., Manuscript submitted for publication].

Targeting a more specific skill set, a socio-cognitive habilitation program to improve mathematic skills and behavioral problems was implemented for 56 children aged 3–10 years with a diagnosis of FAS or partial FAS [Kable et al., 2007]. All participants in the study received educational support, including a neurodevelopmental assessment and guidance in obtaining an appropriate educational placement and

in developing an individualized education plan. In the math intervention group, children also received short-term (six sessions) individualized instruction. Their caregivers received training on how to facilitate their child's learning readiness and the acquisition of mathematical skills at home. Findings indicated that children who received the math intervention in addition to educational support showed greater gains on mathematics outcome measures compared to those who received educational support only [Kable et al., 2007], and these gains were maintained at 6-month follow-up [Coles et al., 2009].

Adnams et al. [2007] demonstrated the efficacy of a school-based, language and literacy training (LLT) intervention for 9-year-old children with FASDs in South African. In this study, 40 children with FASDs were assigned to either the intervention condition (n = 20) or an FASD control group (n = 20). A nonalcohol exposed group was comprised of 25 children. Compared to the FASD control group, the LLT group showed significant improvements in the domains of (recognizing) written letters, syllable manipulation, word and nonword reading, and nonword spelling. However, the LTT group did not differ significantly from the FASD control group on measures of scholastic ability posttreatment, and both FASD groups continued to lag significantly behind the nonexposed control group on scholastic measures.

To address the working memory deficits commonly seen in children with prenatal alcohol exposure, Loomes et al. [2008] provided training in the use of rehearsal strategies to 33 children with FASDs, aged 4–11 years. The treatment group showed a significant increase in their scores on a digit span task across three sessions (pretest; Posttest 1: immediately after training; Posttest 2: 6–21 days after training), whereas the control group showed no such improvement. Moreover, although the treatment and control groups showed no differences in their performance on a digit span task either pretest or immediately following instruction, the treatment group showed greater recall on a digit span test than the control group at the second posttest. Additionally, the treatment group showed behavioral evidence of increased use of rehearsal strategies at Posttest 1 and 2, whereas the control group showed no significant change in the use of such strategies.

Such studies are promising in that they suggest that while the impairments associated with PAE are often profound and persistent, children with FASDs can benefit significantly from interventions aimed at remediating some of those deficits. However, there also appear to be limits to the improvements yielded by these interventions, and additional studies that identify potential predictors of treatment response (e.g., IQ, level of prenatal alcohol exposure, etc.) may help clarify whether particular interventions are best suited to particular subgroups of alcohol-exposed individuals.

It is imperative that both school and mental health professionals are better trained in recognizing that PAE yields a broad continuum of effects. Many of the students who are most in need of educational and cognitive interventions may not meet the full criteria for FAS, and thus may be less immediately identifiable. Some children with FASDs may have IQs in the normal range [Streissguth et al., 2004], and consequently they may have difficulty qualifying for special education services. Thus, it is particularly important to assess and document impairments in other areas of neurocognitive functioning, including executive dysfunction, speech and language delays, and specific learning deficits, so that the need for services in specific domains is not overlooked. Additional efforts are also needed to develop early intervention programs to facilitate learning in young children with FASDs, as well as those that provide intensive academic support for adolescents with FASDs, who are at high risk for school failure and early school withdrawal.

Parenting Interventions

Children with FASDs can be particularly challenging to their parents because of the broad impact PAE can have on their behavioral, emotional, and cognitive functioning. Difficulties in these domains can be evident early on and can set the stage for a compromised parent–child relationship. For example, O'Connor et al., [1992] found in a sample of infants that PAE predicted infant negative affect, which in turn predicted less positive mother-infant interaction, which in turn was associated with less secure infant attachment. Furthermore, because of alcohol-exposed children's difficulties learning from experience, understanding contingencies, and generalizing to new situations or settings, parents and caregivers may find that parenting strategies that often work with other children are less effective with this group of children. Thus, enhancing the quality of the parent–child relationship, decreasing parent stress, fostering effective parenting skills, and increasing parents' sense of self-efficacy are all critical components of any interventional approach for individuals with FASDs.

Parent–child interaction therapy

Gurwitch et al. [see Bertrand on behalf of the FASD Intervention Group, 2009] compared the effectiveness of two interventions, parent–child interaction therapy [PCIT; Eyberg and Boggs, 1998] and parenting support and management (PSM), which incorporated components of other parent training interventions, for children aged 3–7 years who had been diagnosed with FAS or other alcohol-related disorders. Both groups participated in 14 weekly, 90-min sessions. Parents and children were seen conjointly in the PCIT condition, whereas PSM groups were for parents only. Both groups showed decreases in parental stress and child behavior problems posttreatment. There were no significant differences between the two groups, although there was a trend for parents in the PCIT condition to show greater decreases in stress than those in the PSM condition. Parents in both groups reported similar levels of satisfaction with the intervention they received. Such findings may suggest that parents of children with FASDs benefit from both relationship-focused and behaviorally oriented interventions. However, given the lack of a no-treatment control group, it is difficult to know whether to attribute posttreatment gains to specific components of the treatment approaches or whether improvements were primarily due to more generic factors such as therapist support.

Behavioral consultation

Given the persistence of the impairments associated with prenatal alcohol exposure, parents and caregivers of children with FASDs may benefit from long-term support. Olson et al. [see Bertrand on behalf of the FASD Intervention Group, 2009] developed and evaluated a sustained model of supportive behavioral consultation, families moving forward [FMF; Olson et al., Manuscript in preparation], to address the needs of families raising children with FASDs, enhance parental self-efficacy, and decrease child behavior problems. Parents and caregivers were taught to use antecedent-based behavior strategies, and how to make adjustments in

the physical and caregiving environment to optimize the child's functioning. School personnel were provided with focused consultation, and families were linked with appropriate community services as needed. Although FMF is a manualized intervention, it can be customized to meet the needs of individual families. The study sample consisted of 52 children with FASDs aged 5–11 years and their caregivers. Families received either the FMF intervention or the community standard of care. Caregivers in the FMF group received 16 in-home sessions every other week over the course of 9–11 months. Following the intervention, caregivers participating in the FMF group showed significant improvements in their sense of parenting efficacy, and a higher percentage perceived that their family needs were met, compared to caregivers in the community standard of care group. Furthermore, caregivers in the FMF group reported significantly greater improvements in child behavior problems post-intervention than did caregivers in the comparison group.

Such research represents important advances in developing and establishing the efficacy of parenting interventions for parents and caregivers of alcohol-exposed children. However, there remain a number of potentially fruitful avenues of investigation to pursue. For example, there are currently no studies of interventions for parents of infants or toddlers with FASDs. One productive direction might be the application and evaluation of existing attachment-based interventions for such parents. As noted earlier, children with PAE are at increased risk for insecure attachment, and such interventions may serve to enhance the quality of infant–parent attachment in this at-risk population. Moreover, teaching parents how to respond sensitively and consistently to their infant's emotional cues may ultimately enhance these children's own capacity for self-regulation. Evidence-based interventions for parents and caregivers of adolescents with FASDs are also critical. Interventions aimed at teaching parents and caregivers to effectively set limits and provide increased monitoring of their adolescent's activities and peer associations may decrease the likelihood of poor decision-making that can yield dire consequences and exploitation by older, savvier peers (or even adults). Different treatment approaches may also be needed for biological versus foster/adoptive parents who may face some similar struggles in raising a child with an FASD, but are also, likely, each dealing with some distinct challenges.

Adaptive Skills Training

Individuals with FASDs show deficits across multiple domains of adaptive functioning, including communication, socialization, and personal and community skills even when controlling for differences in intellectual functioning [Whaley et al., 2001; Jirikowic et al., 2008]. Parents of children with FASDs have observed their struggles to master tasks such as getting dressed, telling time, or counting change. These deficits require parents and caregivers to provide almost constant support and supervision in order for these children to function in their daily lives. One parent of a child with PAE poignantly observed, "even if she has been told a thousand times, she always needs somebody to tell her what's coming up next. You're living with someone who always needs you" [VON Canada, 2006, p 12]. Clearly, there is an urgent need for interventions that promote the development of age-appropriate adaptive skills to help individuals with FASDs function more independently in their daily lives.

Social skills interventions

Children with FASDs exhibit considerable impairments in social behavior, including difficulties understanding social cues, processing social information, difficulty communicating in social contexts, and indiscriminant social behavior [Carmichael-Olson et al., 1998; Streissguth and O'Malley, 2000; McGee et al., 2008, 2009]. Such deficits represent an important target for intervention for this population, as poor peer relationships are predictive of early withdrawal from school and delinquency, as well as anxious and depressive symptoms [Paetsch and Bertrand, 1997; Patterson et al., 1998; Waldrip et al., 2008].

In our own research [O'Connor et al., 2006], we adapted an evidence-based, manualized, parent-assisted social skills intervention, children's friendship training [CFT; Frankel and Myatt, 2003], for use with children with FASDs. CFT teaches social skills demonstrated to discriminate accepted from rejected children, including parent-assisted peer network formation, informational exchange with peers leading to common-ground activities, peer entry, and play date skills. Such skills are taught 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 with a peer. The efficacy of CFT versus a delayed treatment control (DTC) was evaluated for 100 children ages 6–12 years with FASD. Compared to children in the DTC group, those who participated in CFT showed significantly greater improvement in their knowledge of appropriate social behavior and were rated by their parents as have better social skills and fewer behavior problems posttreatment, and these improvements were retained over a 3-month follow-up period.

Safety skills

Children with disabilities and behavior problems are at increased risk for unintentional injuries [Sherrard et al., 2004]. The impulsivity, difficulties in behavioral inhibition, and poor judgment often demonstrated by children with FASDs place them in this high-risk group. Coles et al. [2007] designed a computer-based intervention to increase fire and street safety skills in 32 children aged 4–10 years old with diagnoses of FAS or partial FAS. Using computer games, children were divided into two groups and each group was taught appropriate rules and behavioral sequences in response to either one of two situations: a fire in their home or crossing a city street. Each group served as the control group for the other. Children in each intervention group (fire or street safety) demonstrated significantly greater gains in safety-related knowledge and appropriate behavioral responses compared to the control group.

Individuals with FASDs would benefit from additional interventions to address their deficits in adaptive skills. Social skills training for adolescents with FASDs may increase their ability to establish and maintain friendships with appropriate peers and thus lessen their risk for socializing with inappropriate peers. Adults with FASDs would greatly benefit from the development of interventions to provide training in both life skills and vocational skills to increase their ability to negotiate the tasks required to live independently, including finding and maintaining gainful employment, securing a place to live, managing their finances, accessing health care, and building a social network.

Pharmacological Interventions

Numerous studies have found individuals with FASDs to be at elevated risk for disruptive behavior problems, mood disorders, substance use or abuse problems, and psychiatric confinement [Famy et al., 1998; O'Connor et al., 2002; Burd et al., 2003; Streissguth et al., 2004; Bhatara et al., 2006; Burd et al., 2007; Walthall et al., 2008]. Given such findings, it is not surprising that children with FASDs often receive pharmacological intervention. Recent community and clinic-based surveys indicate that stimulants are commonly used in children with FASD [O'Malley and Nanson, 2002]. Despite their common use, the empirical support for the efficacy of these medications in FASD is limited. Also of note is the suggestion that alcohol-exposed children seen in clinical settings are prescribed a higher number of medications than their nonexposed counterparts. In an unpublished study examining the medication status of 163 consecutive inpatient admissions to the UCLA Child Psychiatric Inpatient Service, children with prenatal alcohol exposure averaged 2.56 medications on admission compared to unexposed children who averaged 1.68 medications on admission [O'Connor, Unpublished raw data]. In terms of the distribution of admission medications, children with no exposure were significantly more likely to be on no medication or on only one medication in comparison to children with exposure who were more likely to be on two or more medications.

In light of the frequency with which these individuals are receiving medications and factors potentially complicating their response to medication, it is important to consider current findings of the efficacy of pharmacological interventions for this population. However, research on the efficacy of medication for children with prenatal alcohol exposure remains relatively limited. Controlled studies examining the efficacy of stimulant medication in these children reveal a mixed pattern of findings. In a fixed dose crossover study of four children diagnosed with FAS or partial FAS, Oesterheld et al. [1998] found positive effects of methylphenidate compared to placebo on parent and teacher ratings of hyperactive and impulsive symptoms, but no such effects for inattention. In another crossover study of 11 children with FASDs and ADHD, Snyder et al., [1997] also found significant effects for stimulants (Methylphenidate, Methylphenidate SR, Pemoline, or Dexedrine) compared to placebo on parent reports of hyperactive symptoms, but no improvement in measures of attention or impulsivity. Both of these studies suggest some promise for the benefits of stimulant medication, but both were limited by small samples. Retrospective studies of medication response among individuals with FASDs have also yielded mixed results. O'Malley et al., [2000] reported that in a sample of children diagnosed with FAS/ARND and ADHD, 79% of patients given dextroamphetamine showed a positive clinical response, whereas only 22% of the patients who were given methylphenidate showed a positive clinical response. In a retrospective chart review of 22 patients with FASDs, Coe et al. [2001] found 63% exhibited positive effects of stimulant medications on symptoms of impulsivity, inattentiveness, or hyperactivity. However, a significant number of the trials (approximately one third) had to be stopped due to concerns regarding negative side effects. Most recently, Doig et al. [2008] reviewed 41 medication trials in a sample of 27 children diagnosed with an FASD and ADHD. The majority of the trials consisted of stimulant medications, although some included combinations of psychostimulants with other medications, such as clonidine, risperidone, or carbamazepine, Significant effects were seen on all three domains of the MTA-SNAP-IV, although more children received normalized scores in the hyperactive/impulsive and oppositional/defiant domains than in the inattentive domain.

Although there is some preliminary evidence supporting the efficacy of at least stimulant medications in some individuals with FASDs, additional research in this area is urgently needed. Clearly, large-scale randomized, crossover, double-blind studies are needed to assess the efficacy of not only stimulant medications, but other classes of medications as well. Moreover, large-scale studies may be useful in identifying factors that help predict treatment response to various medications, which may allow pharmacological interventions to be tailored for alcohol-exposed individuals with particular profiles of symptoms or comorbid conditions. Efficacy data are also needed to inform the clinical practice of practitioners who must manage patients who present with prenatal alcohol exposure and frequently a host of comorbid mental health issues [Burd and Christensen, 2009]. Finally, clinical observations suggest that some alcohol-exposed individuals may have less favorable or atypical reactions to some medications, which may lead to the prescription of higher doses because of nonresponse and/or multiple medications to manage side effects. Thus, efficacy studies are also critical to decrease the likelihood of medication mismanagement and adverse reactions in this population.

Case Management

Comorbid psychiatric issues

The myriad mental health issues often seen in alcohol-exposed individuals comprise a major focus of the case management that is needed for this population. In a longitudinal study tracking adverse outcomes of adolescents and adults with FAS or FAE, 94% of these individuals were found to have experienced mental health problems [Streissguth et al., 1996]. Huggins et al., [2008] have also noted that many of the risk factors commonly cited for suicide are often present in alcohol-exposed individuals, and a study of adults with FAS or FAE found that 23% reported a previous suicide attempt [Streissguth et al., 1996]. The serious psychiatric issues commonly seen in this population underscore the need for ongoing mental health services, which may include psychosocial and pharmacological interventions, as well as services aimed at preventing relapse. It is important that any treatment for concomitant mental health issues be informed by the individual's history of PAE and their profile of neurocognitive impairments to ensure that these individuals are provided with appropriate treatment. It is not uncommon for individuals with FASDs to be viewed as resistant to or uncooperative with treatment, when in fact they are being provided with interventions that are unsuitable or have not been appropriately adapted to accommodate their cognitive and behavioral deficits.

Substance and alcohol abuse problems

Individuals with histories of PAE are at increased risk for substance and alcohol abuse problems later in life [Baer et al., 2003; Alati et al., 2008]. Both prevention and intervention programs are needed for this population to provide alcohol-related education to individuals with FASDs and their parents and caregivers (including the risks of drinking during pregnancy), to teach them strategies for avoiding situa-

tions and behaviors that may encourage high-risk drinking, and to address ongoing substance and alcohol use/abuse problems. Such programs may also help reduce the occurrence of additional alcohol-exposed pregnancies in subsequent generations.

Sexuality

In a longitudinal study of adolescents and adults with FASDs, Streissguth et al. [2004] found that 48% of their sample had engaged in inappropriate sexual behavior, most commonly promiscuity and inappropriate sexual advances. Combined with poor judgment, impulsivity, and difficulty anticipating the consequences of one's actions, such behavior can place these individuals at risk for unplanned pregnancies, STDs, and sexual assaults (either as victims or perpetrators). Interventions that provide developmentally appropriate sex education, including safe sex and contraceptive practices, and how to recognize and maintain appropriate boundaries are critical for this population. Baumbach [2002] has also noted the need to modify conventional treatment strategies when working with alcohol-exposed adolescents who have engaged in sexually offending behavior.

Legal problems

Among the most concerning negative outcomes for individuals with FASDs is their frequent entry into the criminal justice system [Burd et al., 2004; Streissguth et al., 2004; Fast and Conry, this issue]. Because of their pattern of cognitive impairments, which may include a normal IQ in the presence of significant executive functioning deficits, such individuals may be deemed capable of participating in their own defense when in fact they have a limited understanding of police and courtroom procedures. Individuals with FASDs may be vulnerable to confessing to crimes they did not commit, and they may have difficulty understanding their legal rights, including their right to counsel and to not incriminate themselves [Fast and Conry, 2004]. Thus, it is critical that medical and mental health care providers treating alcohol-exposed individuals provide consultation and education to attorneys, judges, and law enforcement regarding the ways in which underlying neurocognitive deficits may impact the behavior (including decision making) of individuals with FASDs. Parents and caregivers of alcohol-exposed individuals must also be educated regarding how to protect their children's legal rights and to insure they obtain appropriate legal representation.

Medical issues

The effect of alcohol on a developing fetus place individuals with prenatal alcohol exposure at increased risk for a range of medical problems, including cardiac problems, skeletal defects, sensory deficits, and dental problems [Church et al., 1997; Autti-Rämö et al., 2006]. Other research has documented that children with FASDs are hospitalized more frequently than non-exposed children [Kvigne et al., 2004]. Thus, practitioners providing case management for these individuals must also ensure that their medical needs receive adequate attention and follow-up.

Because of the persistent nature of the impairments associated with prenatal alcohol exposure, there is need for interventions that address the manifestations of these impairments across the entire life-span.

Recommendations and Future Directions

Because of the persistent nature of the impairments associated with PAE, there is need for interventions that address the manifestations of these impairments across the entire life-span. However, most of the existing evidence-based interventions have been targeted at school-aged children, highlighting the need for interventions for alcohol-exposed individuals at both ends of the developmental spectrum—infants and toddlers, and older adolescents and adults.

The compelling evidence for neuroplasticity in early brain development [Johnston et al., 2009] suggests that early intervention for children with FASDs may represent a critical opportunity to remediate some of the brain damage done by PAE. Notably, children with FASDs are often not referred for diagnosis until they are school-aged, suggesting that by the time many of these children are diagnosed, an important window of opportunity for early intervention has been missed. Olson et al. [2007] recently reported on data from the Washington State FAS Diagnostic and Prevention Network (FAS DPN), which indicated that the average age of referral for diagnosis was 9.5 years. Thus, increased efforts must be directed towards both identifying children with FASDs at a much earlier age and providing them with developmentally-appropriate interventions. Further along the developmental continuum, longitudinal research has documented the persistence of both primary deficits and secondary disabilities into adolescence and adulthood [Streissguth et al., 2004], suggesting that affected individuals are likely to need to services and support throughout the life span. Moreover, many individuals with FASDs are raised in the foster care system, and they may be especially vulnerable when they are no longer under the auspices of that system and no longer receiving support or services. Interventions that are aimed at reducing participation in high-risk activities (e.g., alcohol and drug use) would be especially important for alcohol-exposed teens, as would be programs designed to assist adolescents and young adults with PAE in negotiating tasks that will allow them to live and function independently.

To facilitate diagnosis and treatment of FASDs, it is imperative that professionals working in health care, education, social services, and the criminal justice system are properly trained in how to recognize individuals with PAE and educated regarding appropriate interventions for this population [Gahagan et al., 2006; FASD Regional Training Centers Consortium, 2007; Wedding et al., 2007; Mutch et al., 2009; Paley et al., 2009]. In some cases, it may also be important to change the attitudes of professionals who come in contact with and provide services to alcohol-exposed individuals and their families. Some health care providers may believe that "the damage is done," and may be unaware of available treatment options. Some providers may convey judgmental or blaming attitudes to biological parents, which may make families less likely to seek services. Thus, there remains a strong impetus to provide better education and training to students and professionals in medical and allied health fields, as well as community providers to improve preven-

tion, diagnostic, and intervention services for this high-risk population.

A comprehensive approach to intervention entailing coordination across multiple systems of care is strongly advocated in the treatment of FASDs [Streissguth, 1997; Olson et al., 2007]. One recently developed program, "New Choices," designed to address the social and mental health needs of mothers with substance abuse problems and their children has yielded improvements in mothers' reports of social support, depressive symptoms, and empathy for their children, as well as improvements in their children's social development [Niccols and Sword, 2005]. In the Parent and Child Assistance Program [PCAP; Grant et al., 2002], paraprofessionals worked with mothers with alcohol and substance use problems to connect them with appropriate services, taught them to access services for both themselves and their children, and facilitated their ability to provide a safe caregiving environment for their children. A subsequent adaptation of PCAP for young women with FASDs indicated that participation in PCAP resulted in a reduced percentage of women with unmet mental health and medical needs, and an increased percentage with stable housing, as well as decreases in alcohol and substance use and increases in the use of reliable contraception, outcomes that are likely to contribute to the prevention of additional alcohol-exposed pregnancies [Grant et al. 2004]. Such approaches are also critical in the light of the multitude of other significant postnatal risk factors that may co-occur with prenatal alcohol exposure. Hannigan and Berman [2000] have noted that whatever vulnerability is conferred by PAE is often exacerbated by "at-risk environments." Thus, comprehensive programs that aim to address the other risk factors in those environments, such as parental substance abuse, parental psychopathology, and interparental conflict, represent a promising direction for intervention.

CONCLUSION

The current review highlights an emerging body of research demonstrating that there are a number of treatment approaches that can effectively remediate some of the impairments associated with PAE. Encouragingly, in a number of studies, existing evidence-based interventions were successfully adapted for children with FASDs [e.g., O'Connor et al., 2006; Kable et al., 2007]. Such findings highlight the potential value in the further exploration of how other current treatment approaches for high-risk populations might be adapted to address the primary deficits and secondary disabilities experienced by individuals with FASDs. Another potentially fruitful direction for future intervention research would be to develop and test the efficacy of more comprehensive, multi-level approaches that address impairments in multiple domains of functioning and that seek to address the negative effects not only of PAE, but of adverse postnatal environments as well. Finally, there must be a concerted and united effort by both researchers and clinicians to translate evidence-based interventions into more accessible, community-based services for individuals with FASDs and their families. The immense economic and social burdens created by FASDs underscore the urgent need for professionals in the medical, mental health, and educational fields to respond to the needs of affected individuals and their families. ■

REFERENCES

Adnams CM, Sorour P, Kalberg WO, et al. 2007. Language and literacy outcomes from a pilot intervention study for children with fetal alcohol spectrum disorders in South Africa. Alcohol 41:403–414.

Alati R, Clavarino A, Najman JM, et al. 2008. The developmental origin of adolescent alcohol use: findings from the mater university study of pregnancy and its outcomes. Drug Alcohol Depend 98:136–143.

Autti-Rämö I, Fagerlunch A, Ervalahti N, et al. 2006. Fetal alcohol spectrum disorders in Finland: clinical delineation of 77 older children and adolescents. Am J Med Genet 140A:137–143.

Baer JS, Sampson PD, Barr HM, et al. 2003. A 21-year longitudinal analysis of the effects of prenatal alcohol exposure on young adult drinking. Arch Gen Psychiatry 60:377–385.

Barkley RA. 1998. Attention-deficit hyperactivity disorder. A handbook for diagnosis and treatment, 2nd ed. New York: Guilford.

Baumbach J. 2002. Some implications of prenatal alcohol exposure for the treatment of adolescents with sexually offending behaviors. Sexual Abuse J Res Treatment 14:313–237.

Bertrand J. On behalf of the FASD Intervention Group 2009. Interventions for children with fetal alcohol spectrum disorders: overview of findings for five innovative research projects. Res Dev Disabil 30:986–1006.

Bhatara V, Loudenberg R, Ellis R. 2006. Association of attention deficit hyperactivity disorder and gestational alcohol exposure. J Attention Disord 9:515–522.

Brown JD, Sigvaldason N, Bednar LM. 2004. Foster parent perceptions of placement needs for children with a fetal alcohol spectrum disorder. Children Youth Serv Rev 27: 309–327.

Burd L. 2006. Interventions in FASD: we must do better. Child Care Health Dev 33: 398–400.

Burd L, Carlson C, Kerbeshian J. 2007. Fetal alcohol spectrum disorders and mental illness. Int J Disabil Hum Dev 6:383–396.

Burd L, Christensen T. 2009. Treatment of fetal alcohol spectrum disorders: are we ready yet? J Clin Psychopharmacol 29:1–4.

Burd L, Klug MG, Martsolf JT, et al. 2003. Fetal alcohol syndrome: neuropsychiatric phenomics. Neurotoxicol Teratol 25:697–705.

Burd L, Selfridge R, Klug M, et al. 2004. Fetal alcohol syndrome in the United States corrections system. Addict Biol 9:177–178.

Carmichael Olson H, Feldman JJ, Streissguth AP, et al. 1998. Neuropsychological deficits in adolescents with fetal alcohol syndrome: clinical findings. Alcohol Clin Exp Res 22:1998–2012.

Carmichael Olson H, Sampson PD, Barr H, et al. 1992. Prenatal exposure to alcohol and school problems in late childhood: a longitudinal prospective study. Dev Psychopathol 4:341–359.

Church MW, Eldis F, Blakley BW, et al. 1997. Hearing, language, speech, vestibular, and dentofacial disorders in fetal alcohol syndrome. Alcohol Clin Exp Res 21:227–237.

Coe J, Sidders J, Riley K, et al. 2001. A survey of medication responses in children and adolescents with fetal alcohol syndrome. Ment Health Aspects Dev Disabil 4:148–155.

Coles CD, Kable JA, Taddeo E. 2009. Math performance and behavior problems in children affected by prenatal alcohol exposure: intervention and follow-up. J Dev Behav Pediatr 30:7–15.

Coles CD, Strickland DC, Padgett L, et al. 2007. Games that "work": using computer games to teach alcohol-affected children about fire and street safety. Res Dev Disabil 28: 518–530.

Doig J, McLennan JD, Gibbard WB. 2008. Medication effects on symptoms of attention-deficit hyperactivity disorder in child with fetal alcohol spectrum disorder. J Child Adolesc Psychopharmacol 18:365–371.

Duquette C, Stodel DL. 2005. School experiences of students with fetal alcohol spectrum disorder. Exceptionality Educ Can 15:51–75.

Eyberg SM, Boggs SR. 1998. Parent-child interaction therapy for oppositional preschoolers. In: Shaefer CE, Briesmeister JM, editors. Handbook of parent training: parents as cotherapists for children's behavior problems, 2nd ed. New York, NY: Wiley. p 61–92.

Famy C, Streissguth AP, Unis AS. 1998. Mental illness in adults with fetal alcohol syndrome or fetal alcohol effects. Am J Psychiatry 155:552–554.

FASD Regional Training Centers Consortium. 2007. Educating health professionals about fetal alcohol spectrum disorders. Am J Health Educ 38:364–373.

Fast DK, Conry J. 2004. The challenge of fetal alcohol syndrome in the criminal justice system. Addict Biol 9:161–166.

Frankel F, Myatt R. 2003. Children's friendship training. New York, NY: Brunner-Routledge.

Gabriel KI, Johnston S, Weinberg J. 2002. Prenatal ethanol exposure and spatial navigation: effects of postnatal handling and aging. Dev Psychobiol 40:345–357.

Gahagan S, Sharpe TT, Brimacombe M, et al. 2006. Pediatricians' knowledge, training, and experience in the care of children with fetal alcohol syndrome. Pediatrics 118:657–668.

Grant T, Huggins J, Connor P, et al. 2004. A pilot community intervention for women with fetal alcohol spectrum disorders. Commun Ment Health J 40:499–511.

Grant T, Streissguth A, Ernst C. 2002. Benefits and challenges of paraprofessional advocacy

with mothers who abuse alcohol and drugs and their children. Zero Three 23:14–20.
Green JH. 2007. Fetal alcohol spectrum disorders: understanding the effects of prenatal alcohol exposure and supporting students. J School Health 77:103–108.
Guerri C, Bazinet A, Riley EP. 2009. Foetal alcohol spectrum disorders and alterations in brain and behavior. Alcohol Alcohol Res 44:108–114.
Guerri C, Pascual M, Garcia-Minguillán MC, et al. 2005. Fetal alcohol effects: potential treatments from basic science. Alcohol Clin Exp Res 29:1074–1079.
Hannigan JH, Berman RF. 2000. Amelioration of fetal alcohol-related neurodevelopmental disorders in rats: exploring pharmacological and environmental treatments. Neurotoxicol Teratol 22:103–111.
Hannigan JH, Berman RF, Zajac CS. 1993. Environmental enrichment and the behavioral effects of prenatal exposure to alcohol in rats. Neurotoxicol Teratol 15:261–266.
Hannigan JH, O'Leary-Moore SK, Berman RF. 2007. Postnatal environmental or experiential amelioration of neurobehavioral effects of perinatal alcohol exposure in rats. Neurosci Biobehav Rev 31:202–211.
Harwood H. (The Lewin Group for the National Institute on Alcohol Abuse and Alcoholism). 1998. Updating estimates of the economic costs of alcohol abuse in the United States: estimates, update methods, and data. Rockville, MD, USA: National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Department of Health and Human Services; 1998. Report No.: 98-4327. Contract No.: N01-AA-7-1010.
Huggins J, Grant T, O'Malley K, et al. 2008. Suicide attempts among adults with fetal alcohol spectrum disorders: clinical implications. Ment Health Aspects Dev Disabil 11:33–41.
Jirikowic T, Kartin D, Olson HC. 2008. Children with fetal alcohol spectrum disorders: a descriptive profile of adaptive function. Can J Occupational Ther 75:238–248.
Johnston MV, Ishida A, Ishida WN, et al. 2009. Plasticity and injury in the developing brain. Brain Dev 31:1–10.
Jones KL, Smith DW. 1973. Recognition of the fetal alcohol syndrome in early infancy. Lancet 2:999–1001.
Kable JA, Coles CD, Taddeo E. 2007. Socio-cognitive habilitation using the math interactive learning experience program for alcohol affected children. Alcohol Clin Exp Res 31: 1425–1434.
Kalberg WO, Buckley D. 2007. FASD: what types of intervention and rehabilitation are useful? Neurosci Biobehav Rev 31:278–285.
Kelly SJ, Goodlett CR, Hannigan JH. 2009. Animal models of fetal alcohol spectrum disorders: impact of the social environment. Dev Disabil Res Rev 15:200–208.
Kodituwakku PW. 2007. Defining the behavioral phenotype in children with fetal alcohol spectrum disorders: a review. Neurosci Biobehav Rev 31:192–201.
Kvigne VL, Leonardson GR, Neff-Smith M, et al. 2004. Characteristics of children who have full or incomplete fetal alcohol syndrome. J Pediatr 145:635–640.
Laugeson EA, Paley B, Schonfeld A, et al. 2007. Adaptation of the children's friendship training program for children with fetal alcohol spectrum disorders. Child Fam Behav Ther 29:57–69.
Lee MH, Rabe A. 1999. Infantile handling eliminates reversal learning deficits in rats parentally exposed to alcohol. Alcohol 18:49–53.
Loomes C, Rasmussen C, Pei J, et al. 2008. The effects of rehearsal training on working memory span of children with fetal alcohol spectrum disorder. Res Dev Disabil 29: 113–124.
Lupton C, Burd L, Harwood R. 2004. Cost of fetal alcohol spectrum disorders. Am J Med Genet 127C:42–50.
Mattson SN, Riley EP, Gramling L, et al. 1998. Neuropsychological comparison of alcohol-exposed children with or without physical features of fetal alcohol syndrome. Neuropsychology 12:146–153.
May PA, Gossage JP. 2001. Estimating the prevalence of fetal alcohol syndrome: a summary. Alcohol Res Health 25:159–167.
May PA, Gossage JP, Kalberg WO, Robinson LK, Buckley D, Manning M, Hoyme HE. 2009. Prevalence and epidemiologic characteristics of FASD from various research methods with an emphasis on recent in-school studies. Dev Disabil Res Rev 15:176–192.
McGee CL, Bjorkquist OA, Price JM, et al. 2009. Social information processing in children with histories of heavy prenatal alcohol exposure. J Abnormal Child Psychol 37:817–830.
McGee CL, Fryer SL, Bjorkquist OA, et al. 2008. Social problem solving deficits in adolescents with prenatal exposure to alcohol. Am J Drug Alcohol Abuse 34:423–431.
McGee CL, Riley EP. 2007. Social and behavioral functioning in individuals with prenatal alcohol exposure. Int J Disabil Hum Dev 6: 369–382.
Mutch R, Peadon EM, Elliott EJ, et al. 2009. Need to establish a diagnostic capacity for foetal alcohol spectrum disorders. J Pediatr Child Health 45:79–81.
Niccols A, Sword W. 2005. "New choices" for substance using mothers and their young children: preliminary evaluation. J Substance Use 10:239–251.
O'Connor MJ, Frankel F, Paley B, et al. 2006. A controlled social skills training for children with fetal alcohol spectrum disorders. J Consult Clin Psychol 74:639–648.
O'Connor MJ, Shah B, Whaley S, et al. 2002. Psychiatric illness in a clinical sample of children with prenatal alcohol exposure. Am J Drug Alcohol Abuse 28:743–754.
O'Connor MJ, Sigman M, Kasari C. 1992. Attachment behavior of infants exposed prenatally to alcohol: mediating effects of infant affect and mother-infant interaction. Dev Psychopathol 4:243–256.
Olson HC, Jirikowic T, Kartin D, et al. 2007. Responding to the challenge of early intervention for fetal alcohol spectrum disorders. Infants Young Children 20:172–189.
O'Malley KD, Koplin MD, Dohner VA. 2000. Psychostimulant clinical response in fetal alcohol syndrome. Can J Psychiatry 45: 90–91.
O'Malley KD, Nanson J. 2002. Clinical implications of a link between fetal alcohol spectrum disorder and attention-deficit hyperactivity disorder. Can J Psychiatry 47:349–354.
Oesterheld JR, Kofoed L, Tervo R, et al. 1998. Effectiveness of methylphenidate in native American children with fetal alcohol syndrome and/or attention deficity/hyperactivity disorder: a controlled pilot study. J Child Adolesc Psychopharmacol 8:39–48.
Paetsch JJ, Bertrand LD. 1997. The relationship between peer, social, and school factors, and delinquency among youth. J School Health 67:27–33.
Paley B, O'Connor MJ. 2007. Neurocognitive and neurobehavioral impairments in individuals with fetal alcohol spectrum disorders: recognition and assessment. Int J Disabil Hum Dev 6:127–142.
Paley B, O'Connor MJ, Baillie S, et al. 2009. Integrating case topics in medical school curriculum to enhance multiple skill learning: using fetal alcohol spectrum disorders as an exemplary case. Acad Psychiatry 33: 143–148.
Paley B, O'Connor MJ, Frankel F, et al. 2006. Predictors of stress in parents of children with fetal alcohol spectrum disorders. J Dev Behav Pediatr 27:396–404.
Paley B, O'Connor MJ, Kogan N, et al. 2005. Prenatal alcohol exposure, child externalizing behavior, and maternal stress. Parenting Sci Practice 5:29–56.
Patterson GR, Forgatch MS, Yoerger KL, Stoolmiller M. 1998. Variables that initiate and maintain and early-onset trajectory for juvenile offending. Dev Psychopathol 10:531–547.
Premji S, Benzies K, Serrett K, et al. 2006. Research-based interventions for children and youth with a fetal alcohol spectrum disorder: revealing the gap. Child Care Health Dev 33:389–397.
Rasmussen C. 2005. Executive functioning and working memory in fetal alcohol spectrum disorder. Alcohol Clin Exp Res 29: 1359–1367.
Riley EP, Mattson SN, Li T, et al. 2003. Neurobehavioral consequences of prenatal alcohol exposure: an international perspective. Alcohol Clin Exp Res 27:362–373.
Ryan S, Ferguson DL. 2006. On, yet under, the radar: students with fetal alcohol syndrome disorder. Exceptional Children 72:363–379.
Salmon J. 2008. Fetal alcohol spectrum disorder: New Zealand birth mothers' experiences. Can J Clin Pharmacol 15:e191–e213.
Schonfeld AM, Mattson SN, Riley EP. 2005. Moral maturity and delinquency following prenatal alcohol exposure. J Stud Alcohol 66:545–555.
Scott S, Dewane SL. 2007. Clinical competencies for professionals working with children and families affected by fetal alcohol spectrum disorder. J Psychol Practice 14:67–92.
Sherrard J, Ozanne-Smith J, Staines C. 2004. Prevention of unintentional injury to people with intellectual disability: a review of the evidence. J Intell Disabil Res 48:639–645.
Snyder J, Nanson J, Snyder RE, et al. 1997. Stimulant efficacy in children with FAS. In: Streissguth A, Kanter J, editors. The challenge of fetal alcohol syndrome: overcoming secondary disabilities. Seattle, WA: University of Washington Press. p 64–77.
Streissguth AP. 1997. Fetal alcohol syndrome: a guide for families and communities. Baltimore, MD: Paul H. Brooks.
Streissguth AP. 2007. Offspring effects of prenatal alcohol exposure from birth to 25 years: the seattle prospective longitudinal study. J Clin Psychol Med Settings 14:81–101.
Streissguth AP, Barr HM, Kogan J, et al. 1996. Understanding the occurrence of secondary disabilities in clients with fetal alcohol syndrome (FAS) and fetal alcohol effects (FAE): final report to the center for disease control. Seattle: University of Washington, Fetal Alcohol and Drug Unit.
Streissguth AP, Bookstein FL, Barr HM, et al. 2004. Risk factors for adverse life outcomes in fetal alcohol syndrome and fetal alcohol effects. J Dev Behav Pediatr 25:228–238.

Streissguth AP, O'Malley K. 2000. Neuropsychiatric implications and long-term consequences of fetal alcohol spectrum disorders. Semin Clin Neuropsychiatry 5:177–190.

Thomas JD, Sather TM, Whinery LA. 2008. Voluntary exercise influences behavioral development in rats exposed to alcohol during the neonatal brain growth spurt. Behav Neurosci 122:1264–1273.

VON Canada. 2006. Parenting guidelines for families of children with FAS/FAE. Available at: http://www.von.ca/FASD/VON%20FASD%20Research%20Report%20FINAL%2006-06-30.pdf.

Waldrip AM, Malcolm KT, Jensen-Campbell LA. 2008. With a little help from your friends: the importance of high-quality friendships on early adolescent adjustment. Social Dev 17:832–852.

Walthall JC, O'Connor MJ, Paley B. 2008. A comparison of psychopathology in children with and without prenatal alcohol exposure. Ment Health Aspects Dev Disabil 11:69–78.

Warren K, Floyd L, Calhoun F, et al. 2004. Consensus statement on FASD. Washington, DC: National Organization on Fetal Alcohol Syndrome.

Watson SMR, Westby CE. 2003. Strategies for addressing the executive function impairments of students prenatally exposed to alcohol and other drugs. Commun Disord Quart 24:194–204.

Wedding D, Kohout J, Mengel MB, et al. 2007. Psychologists' knowledge and attitudes about fetal alcohol syndrome. Fetal alcohol spectrum disorders, and alcohol use during pregnancy. Professional Psychol Res Practice 38:208–213.

Whaley SE, O'Connor MJ, Gunderson B. 2001. Comparison of the adaptive functioning of children prenatally exposed to alcohol to a nonexposed clinical sample. Alcohol Clin Exp Res 25:118–124.