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ORIGINAL PAPER

Fetal Alcohol Spectrum Disorders: Characteristics, Complications, and Treatment

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Abstract Fetal Alcohol Spectrum Disorders (FASD) includes a continuum of disorders that occur in children as a result of their mothers' consumption of alcohol during pregnancy. The most severe of these disorders is Fetal Alcohol Syndrome (FAS). FASD presents differently in every child, but all children with FASD have intellectual and/or behavioral impairments. There is no cure for FASD, but research shows that early intervention and life-long support help those born with FASD to manage the difficulties that come with it. This paper examines the characteristics, complications, and treatment for FASD.

Keywords Fetal alcohol syndrome (FAS) · Fetal alcohol spectrum disorder (FASD) · Counseling · Addictions

Characteristics

The negative effects of drinking alcohol during pregnancy have long been identified, and many efforts have been made to prevent fetal alcohol syndrome (FAS). However, more in depth research over the past couple of decades has indicated that there are varying degrees of severity of fetal alcohol effects, which has led to the current term fetal alcohol spectrum disorders (Hammond 2012). Fetal alcohol spectrum disorders (FASD) are considered a group of symptoms (behavior and learning) a person can be born with that are a direct result from their mother drinking alcohol during pregnancy. The repercussions included in FASD vary in severity and are manifested in various ways across a spectrum (SAMHSA 2012).

FASD is not a specific clinical mental health disorder specified in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM–5*; American Psychiatric Association [APA] 2013); however, FASD encompasses various medical conditions affecting one's cognitive and behavioral functioning. The DSM-5 did acknowledge the need to gather more data on the topic and listed *Neurobehavioral Disorder Associated with Prenatal Alcohol Exposure* in the Conditions for Further Study chapter (APA 2013). The *International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)* lists *Fetal Alcohol Syndrome* under the category of Congenital malformation syndromes due to known exogenous causes, not elsewhere classified (Q86) (World Health Organization 1992).

There are many common characteristics among individuals suffering from the effects of alcohol exposure in the womb (Kable et al. 2016; Ryan and Ferguson 2006). Many individuals with FASD have abnormal facial features such as a flat nasal bridge, smooth ridge between the nose and upper lip, thin upper lip, extra crease in the outer ears, an upturned nose, and a curved pinky finger (Wattendorf and Muemke 2005). Many babies born with FASD have a smaller head size, low body weight, and have shorter-than-average height (Murawski et al. 2015). In addition to these physical characteristics, there are several medical issues that appear to be caused by fetal alcohol exposure. These

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include vision or hearing problems, sleep and sucking problems as a baby, and problems with the heart, kidneys, or bones (CDC 2012). Cognitive impairments are also common among individuals with FASD. These individuals often have impaired cognitive functioning that causes learning disabilities, problems following directions, difficulty understanding the consequences of their actions, poor memory skills, hyperactive behavior, inattentiveness, poor reasoning skills, and speech and language delays (CDC 2012, Kable et al. 2016).

These cognitive and behavioral issues often lead to struggles with academic achievement (CDC 2012). Difficulties adhering to social boundaries and rules, and delays in communication often lead to poor social skills and difficulty building peer relationships (Ryan and Ferguson 2006). Oftentimes youth with FASD who struggle with poor self-regulation abilities exhibit problematic behavior like rule-breaking, that leads to trouble with the law (Novick et al. 2012). One reason academic and social learning are difficult for children with FASD is that they are context-specific learners, which means that it is difficult for them to apply information learned in one context to another situation (Reach to Teach 2007). Children with FASD struggle with social competence which affects both their aptitude to form and keep healthy relationships as well as protect themselves from adverse reactions from others such as bullying. This can lead a child with FASD to become isolated, aggressive, depressed, hyperactive, and showing inappropriate behavior. Interpersonal issues like these continue into adulthood for those with FASD (Kully-Martens et al. 2012).

The specific blend of characteristics listed above present in an individual determines their type of FASD. Alcohol-Related Birth Defects (ARBD) indicate medical problems including problems with the heart, kidneys, bones, or hearing. Some combination of these conditions often occurs together. Individuals with Neurobehavioral Disorder Associated with Prenatal Alcohol Exposure (ND-PAE) have intellectual disabilities and therefore have trouble learning. They also have difficulties regulating their behavior. These problems often lead to low academic achievement and poor impulse control.

The more traditional term, FAS, represents the more severe end of the FASD spectrum, and is the only FASD that is also a clinical diagnosis (Ryan and Ferguson 2006). According to Ryan and Ferguson (2006), there are four diagnostic criteria for FAS are "(1) growth deficiencies that stunt prenatal or postnatal growth; (2) permanent brain damage resulting in neurological abnormalities, delay in development, intellectual impairment, and learning/behavior disabilities; (3) abnormal facial features, including short eye openings, thin upper lip, and reduced or absent philtrum; and (4) maternal alcohol use during pregnancy" (Ryan and Ferguson 2006, p. 363–364). Individuals with FAS have a combination of the physical, mental, medical, and social skills difficulties that are common characteristics of FASD.

Changes in the brain due to fetal alcohol exposure are thought to be the cause of behavior and learning difficulties inherent in individuals born with FASD that they experience throughout their lives. Structural changes in the brain include a permanent loss of tissue in the corpus collosum as well as damage to the basal ganglia and stunted growth of the cerebellum. These abnormalities make it difficult for the different parts of the brain to work together and limit the person's ability to reason and control impulses (National Organization on Fetal Alcohol Syndrome [NOFAS] 2012). Damage to the central nervous system also contributes to difficulties with self-regulation, with up to 90% of children with FASD showing symptoms of hyperactivity and impulsivity (Jones 2004).

Population Numbers

According to the CDC (2012), an estimated 40,000 babies are born with an FASD every year in the United States, ranking FASD on par with children born with autism spectrum disorder. FASD is also one of the leading intellectual disabilities that is preventable (SAMHSA 2012). High prevalence rates are reported all over the world, including from South Africa (World Health Organization 2011), Australia (Fitzpatrick et al. 2015) and America (Bell and Chimata 2015). Approximately, between two and five percent of school-aged children in the United States and Western Europe are born with an FASD (Hammond 2012). The total number of babies born with an FASD is estimated to be three times higher than the number of babies born with FAS specifically (Cannon et al. 2012). Although this is a high incidence rate, it may be a low estimate of the true number of cases because many women under-report their use of alcohol during pregnancy (SAMHSA 2012). Other obstacles that are contributing to the difficulties of finding true prevalence rates are the use of passive methods, differing sampling techniques and disputes of the appropriate diagnostic criteria used to determine FASD in children (May et al. 2014). May and Gossage (2001) contend the three common ways to study FAS include

- Passive systems (use existing medical records within an area);
- Clinic-based studies (collect information from mothers who visit local clinics during their pregnancy); and
- Active case ascertainment (researchers seek, find and recruit children and their families).

Determining accurate prevalence rates will continue to be a problem until the issues mentioned above are globally addressed.

Not only is the incidence rate of FASD high, but also the cost of treating these disorders is very high. The health costs for a child with FAS are nine times greater than health costs for a child without an FASD. The estimated lifetime cost for caring for a person with FAS is two million dollars, and the annual cost to the United States health care system of all disorders under the FASD umbrella is more than six billion dollars (SAMHSA 2012).

According to a study done by the CDC (2012), 7.6% of pregnant women reported drinking alcohol in the past 30 days. Researchers and medical professionals have not been able to identify how much alcohol a woman must consume during pregnancy to cause an FASD. Factors that contribute to the development of FASDs include the amount of alcohol consumed during pregnancy, timing of drinking during pregnancy, vulnerability of a particular fetus, the mother's genetic background, and other maternal factors such as the number of previous births (Reach to Teach 2007). However, the only sure way to prevent FASD is to abstain from alcohol during pregnancy. Women two or three trimesters into pregnancy and drinking four or more drinks consecutively in a day are at the highest risk for having a child with FASD (Burd 2011). Although education about the risk of FASD is important for all groups of women, researchers have identified several groups and behaviors that are associated with higher incidence rates of FASD. An analysis of four states revealed that "Mothers of children with FAS were more likely to be older, non-Hispanic, unmarried, un-employed, and without prenatal care, to smoke during pregnancy, to have a lower educational level, and to have more live born children" (Cannon et al. 2012, p. 90). Other common factors among women giving birth to babies with FASD include receiving public assistance, being on Medicaid at their child's birth, prior treatment for alcohol abuse, marijuana or cocaine use during pregnancy, history of mental illness, and drinking heavily seven days a week during pregnancy. These results mean that it is possible to target interventions for groups of women who are at higher risk for having a child with FAS or FASD (Cannon et al. 2012).

Education

Education is key to the prevention of FASD. Raising public awareness of the risks of consuming alcohol during pregnancy as well as educating medical and allied health students, practitioners, and others who can influence the choices made by women of child bearing age is as important as educating the women themselves (NOFAS 2012). One program that has demonstrated positive results of reaching out to women who are at risk for having a child with an FASD is the CDC's collaborative intervention, Project CHOICES (Project CHOICES Research Group 2002). This program targets women from ages 18 to 44 who are sexually active and drinking alcohol at risk levels before they get pregnant through four sessions with motivational interviewing techniques (CDC 2015). Research has indicated that the CHOICES intervention program significantly reduced the risk of alcohol-exposed pregnancies by 68.5% (Project CHOICES Research Group 2002) and is being used in a variety of clinical and community settings (Johnson et al. 2015). Educating women on the importance of prenatal nutritional supplementation could also be a beneficial component in the impact of FASD. Several studies found that pregnant women who drank had deficiencies in key nutrients (Choline, vitamins A, B6, C, D & E and omega-3, calcium and iron) (Fuglestad et al. 2013; May et al. 2014), but also found mothers who reported drinking during pregnancy and taking nutrient supplements had a lower rate of FASD than mothers who drank and did not take nutrient supplements (Avalos et al.2011; Chambers et al. 2013). Promising pilot studies are also finding that pre and post-natal supplementation of Choline can reduce the negative cognitive impact (problems with memory performance, overall cognitive functioning and fine motor skills) of children with FASD (Fuglestad et al. 2013; Wozniak et al. 2013, 2015).

Foster Care

One complicating factor that makes it difficult to reach out to mothers of children with FASD and to provide services to promote the development of these children is the high number of children with FASD living in foster homes. Estimates are that between 60 and 80% of children with FASD grow up in foster care and/or institutional settings worldwide (Elliot et al. 2008). Children are removed from their initial homes due to parental substance abuse more than any other reason. It is therefore likely that the mothers in these instances are drinking socially before they know they are pregnant. Once moved from their home, 16% of children are moved five or more times (Burd 2011). A study done in Alaska also indicated that foster parents were not prepared nor given support to manage the complex issues that arise when raising a child with FASD (Ryan and Ferguson 2006). Victor, Wozniak and Chang (2008) supported the practice of trying to keep these children from moving to multiple foster care placements when they reported there were variances in behavior and thinking of children living in solely one foster care home and children living in multiple foster homes.

Child welfare organizations (NOFAS 2016) suggest that all children in foster care have more positive outcomes when they remain in stable, long-term foster homes, receive support from the community, and are able to bond with adult caregivers. Unfortunately, FASD makes it difficult for children to form relationships with foster parents and other community members, and the impulsivity and behavior issues do not foster a stable home environment (Jones 2004). Jones (2004) found, and supported, four common themes when examining the interactions between the child, family, and community: the needs of the child, the capacity of the family to support their children, the capacity of community agencies to support the children, and the resources available in the community.

Treatment Issues

Communities

Some common problems that made it difficult for parents to support their children with FASD and adapt to their needs included behavioral problems that disrupted the home environment, the children's struggle to show affection toward their parents, and a lack of support and understanding from the community (Jones 2004). This lack of support and sensitivity to the children's needs increased the stress at home and made it more difficult for parents to maintain a positive home environment. As the children grew up, some factions in the community labeled the kids as troublemakers who were "…willfully bad or out of control" (Jones 2004, p. 3). This lead to a decrease in opportunities and invitations for the children to participate in positive extracurricular activities and an increase in their susceptibility to negative influences such as drug and alcohol use. Impulsive behavior and poor social skills increase adolescents' vulnerability to negative social influences, and these risks increase with age. Adolescents with FASD are also at increased risk for mental health disorders such as depression and anxiety because of their cognitive and relational struggles compounded with their heightened risk of negative behaviors (Jones 2004).

Some children with FASD may present as too friendly or inappropriate in social situations. Usually, the older a person with FASD gets, the more obvious their social deficits seem, and many adults with FASD behave like a six-year-old child would in social situations (Kully-Martens et al. 2012). The study also identified several factors that contributed to the parents' and children's abilities to build a positive support system. The level of understanding and quality of services provided at school had a big impact on the children's success. Unfortunately, for many of these students, the school support was not strong, but in the few instances that it was, the students made improvements academically and socially. Other contributing factors included a high level of parent involvement, firm boundaries and consequences, the severity of the child's needs, community understanding, and collaboration between families and communities (CDC 2016). One study indicated that external supports can strengthen or weaken the support system within the family, and that assistance from child welfare services can improve foster parents' ability to provide a long term, stable environment for their children with FASD (Jones 2004; Kully-Martens et al. 2012).

Justice system

Coupling with the high number of children with FASD in foster care and their increased vulnerability to negative influences is an increased risk of legal trouble. According to the Office of Juvenile Justice and Delinquency Prevention (OJJDP) (2012), "Sixty-one percent of adolescents with FASD have been in legal trouble [and] thirty-five percent of those who are older than age 12 have been incarcerated at some point in their lives" (para. 6). The types of crimes generally committed by these youth tend to be impulsive and unplanned, such as theft and shoplifting. Jones (2004) contends that a child with FASD has problems reading social cues, which could increase their chances for victimization. These complications make it more difficult for families to provide a support system that prevents their youth with FASD from getting in trouble.

Adding to the lack of support for these youth, most people working in the legal system do not understand the effects of FASD or the special needs of this population. The OJJDP (2012) even recognizes that people with FASD may struggle in receiving appropriate care/treatment within the current justice system. This is slowly beginning to change. The Justice Issues Working Group, a component of the Interagency Coordinating Committee on Fetal Alcohol Spectrum Disorders (ICCFASD), has been working with the American Bar Association (ABA) Center on Children and the Law, the National Counsel of Juvenile and Family Court Judges, and other partners to increase awareness in legal and judicial professional concerning how to meet the needs of individuals with FASD (OJJDP 2012).

Schools

Schools play a critical role in the treatment of children with FASD. Many times, children with FASD have the potential to "fall through the cracks" at schools not equipped to help children with special needs. Children that do not have access to appropriate special education programs early in their school years are at an increased risk of developing long-term problems with their education. Making sure that schools have special education programs that are dedicated

and capable of providing adequate care for children with FASD needs to be a top priority for caregivers. Schools can provide a multitude of support services including special education programs, school counselors, teachers trained in special needs, school psychologists and other specialists (Green 2007). School educational plans will need to be individualized since each child will bring with them their own specific set of learning disabilities determined by where the alcohol caused damage in the brain (Blackburn et al. 2010). In addition to an increased likelihood of neurocognitive effects and mental health issues, prenatal exposure to alcohol has been proven to negatively affect a child's academic performance in multiple areas including reading, spatial and verbal memory, phonological processing and arithmetic. Therefore, teachers must strategically consider how to collaborate with academic and health professionals to best meet the unique needs of a student with FASD in order to manage both behavioral and neuropsychological problems that present in a classroom (Green 2007). A particular critical time in the school years will be the transitions from elementary to middle to high school (Blackburn et al. 2010; Ward et al. 2003). A child's needs change during this developmental journey, and the school programs need to be aware of the changing needs and how they can assist in this matriculation.

Protective Factors and Diagnosing

Efforts to improve support for families impacted by FASD, as well as other protective factors and treatments, can greatly enhance the chance of success for these individuals. In addition to the protective factors for children with FASD living in foster care mentioned previously, there are several other protective factors that apply to all children born with FASD (CDC 2012). The first is early diagnosis to provide the child with services as soon as possible and to help the family and school staff understand what the child is dealing with and what they can do to help. As mentioned earlier, the DSM-5 (APA 2013) does not have an official diagnosis for FASD and the ICD-10 (WHO 1992) does list FAS, but clinicians still struggle with proper diagnosing. The National Task force on FAS/FAE (Bertrand et al. 2004) created the document, *Fetal Alcohol Syndrome: Guidelines for Referral and Diagnosis*, in an effort to provide guidelines for professionals to use when trying to diagnosis individuals with FAS.

One critical hindrance in early diagnosing is the lack of reporting by the biological mother. May et al. (2014) found that only 33% of mothers reported their alcohol consumption prior to their child being diagnosed with FAS. Also, of concern is the growing body of research suggesting that FASD goes missed diagnosed in a significant amount of children in foster care. Chasnoff et al. (2015) reported that over 80% of children in their sample had either been misdiagnosed or never diagnosed with FASD. The researchers also mentioned that ADHD was the most common diagnosis given to the participants in the study.

Early identification and a stable home environment can improve the odds of avoiding adverse life events by two to four fold (Reach to Teach 2007). The second protective factor is involvement in special education and social services as early as possible (CDC 2012). This allows the child's treatment to be individualized, and children and families alike may receive counseling to help provide everyone with support to handle the complications of life with FASD. A factor when treating children with FASD is that many of the children do not have low IQs, and therefore, will likely not qualify for special education that is typically determined from basic psychological testing (Green 2007). The third protective factor is a loving, nurturing, and stable home environment (CDC 2012) that promotes structure and positive relationships and helps prevent negative outcomes such as criminal behavior, unemployment, and lack of education. The last protective factor is absence of violence. A family's awareness and efforts to reduce issues related to victimization (neglect, domestic violence or physical/sexual abuse by others), perpetration (fighting, trouble with the law, inappropriate sexual behaviors) can serve as a protective factor (Streissguth et al. 2004). This helps prevent secondary conditions like those mentioned before, and helps children with FASD learn effective ways of showing anger and frustration (CDC 2012).

Treatments

FASD is entirely preventable if women abstain from drinking alcohol during pregnancy. Education about this basic fact is not a cure-all for preventing these disorders because according to Bell and Chimata (2015) many women stop drinking when they find out that they are expecting, about one or two months into their pregnancy, but the damage is already done. Additionally, nearly half of all pregnancies in the U.S. are unplanned (Finer and Zolna 2011). Although there is no cure for negative effects due to fetal alcohol exposure, research shows that early intervention and treatment services can improve a child's cognitive and social development (CDC 2012). As mentioned earlier, there is expanding research on the use of Choline both pre-and postnatally can reduce the impact of alcohol in both cognitive (memory, learning, and fine motor skills) and behavioral (over-activity and inappropriate behaviors) areas (Thomas et al. 2009; Wozniak et al. 2015).

Early intervention services, such as strategies that help children under the age of three learn to talk, walk, and interact with others, are especially helpful. The Child Welfare Information Gateway (2014) listed several prevention

and treatment options such as: family-centered treatment, using recovery coaches, wraparound community services, and support of parents in treatment. Although FASD is not one of the thirteen disabilities covered under the Individuals with Disabilities Education Act, children under the age of three who are at risk for developmental delays (such as those caused by FASD) may be eligible for services. Murawski et al. (2015) suggested using the intervention frameworks from already established disorders like ADHD could be a beneficial step in treatment development. Fortunately, treatments for some symptoms of FASD do not require a diagnosis. Speech therapy to help correct language delays is one example (CDC 2012). Special education classes can also assist with interventions related to arithmetic problems and behavior modification (Streissguth et al. 2004). In addition to an increased likelihood of neurocognitive effects and mental health issues, prenatal exposure to alcohol has been proven to negatively affect a child's academic performance in multiple areas including reading, spatial and verbal memory, phonological processing and arithmetic. Therefore, teachers must strategically consider how to collaborate with academic and health professionals to best meet the unique needs of a student with FASD in order to manage both behavioral and neuropsychological problems that present in a classroom (Green 2007).

Because FASD is a life-long struggle, assistance and services need to not only be customized according to the individual's needs, but also according to his or her age and developmental level (Jones 2004). Infants with FASD frequently have poor sleep-wake cycles, poor weight gain, ear infections, delays in motor development, and speech delays (NOFAS, 2012). Nutritionists, hearing specialists, occupational therapists, and speech therapists can provide services to foster healthy development early on. Toddlers often have continued motor skill delays, are easily distracted, and have small appetites or sensitivity to food texture. Continuing to work with an occupational therapist, establishing consistent routines at home, and serving small food portions with plenty of time to eat are useful strategies for this age.

School age children can benefit from playing with other children who are one or two years younger and doing short, fun activities together. To help children at this age understand cause and effect, repetition, consistency, and clear consequences for behavior are important. Medication, counseling, and participation in structured activities are beneficial for adolescents with FASD who suffer from anxiety and depression. While there are no medications that can specifically treat FASD, the same medications that treat ADHD, depression, anxiety and behavior issues in non-FASD clients can also treat clients with FASD who have the same symptoms. A comprehensive medication evaluation by a psychiatrist is highly recommended if considering medication options. Family counseling and monitoring activities of adolescents with FASD helps prevent victimization and antisocial behaviors. Adults with FASD tend to be more successful at jobs that offer structured, routine activities because they are less likely to cause feelings of overload or stress. The state department of disabilities can help with job skills training, assist in finding appropriate housing,, and locating social clubs for adults with disabilities. These programs provide them with opportunities to continue working on social skills (NOFAS 2012).

Other treatment options, such as person-centered and family-centered treatments can be used with individuals with FASD because they address both health and developmental issues. It's also important to be aware that different family makeups such as families with foster kids or adopted kids, require specific interventions due to unique needs (Olson et al. 2009). Reid et al. (2015) conducted a systematic review of interventions for FASD and found that most were focused on early to middle childhood and few for adolescents and adults. The researchers went on to state that most of the interventions focused on improving specific skills (math, reading and nonverbal reasoning), social skills and parenting skills. Helping school-age children develop coping skills will help them become successful adolescents and adults in the future. Research (Ryan and Ferguson 2006) has indicated that support from teachers and the school system have a big impact on the learning of students with FASD. Teachers with more experience tend to be more flexible and willing to adapt to the special needs of children with FASD. They have also indicated that school wide support and realistic rather than idealistic training are necessary for them to provide the support that these children need (Ryan and Ferguson 2006).

One new technique special education teachers can use to help children with FASD learn is the use of virtual reality games that allow them to learn and practice using new skills. Virtual reality games allow for multiple sensory inputs to be presented in a format that is interesting to the child and allows him or her to learn at their own pace. When information is provided through multiple modalities, it allows children to access different areas of memory when recalling information, which is especially beneficial for children with FASD (Padgett et al. 2006). Other strategies that are beneficial for teachers with children with FASD in their classrooms include fostering positive attitudes toward the student, learning how to interpret misbehavior, adapting teaching styles and the physical space in the classroom, and engaging the whole school community (Reach to Teach 2007).

Conclusion

In summary, FASD causes medical, cognitive, behavioral, and social deficits that individuals must learn to cope with throughout their lives. Despite the life-long sentence of FASD, there are many services and treatments for these individuals. Babies born with FASD have the greatest chance of success as they grow up when their families collaborate with community service providers such as schools, counselors, and medical professionals. Foster care families can play a role in the critical care needed to help children with FASD. Education and prevention will need to be the most important steps in addressing FASD in the future.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Informed Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

Human and Animal Participants No animal or human studies were carried out by the authors for this article.

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