Many children suffer with the effects of fetal alcohol syndrome (FAS). These effects, which are physical, cognitive, and behavioral, although preventable, are irreversible. The following literature review examines the available information on FAS as well as other fetal alcohol spectrum disorders (FASD), including diagnostic information and possible treatments. Information on FASD was used because factors that affect one disorder may have an effect on another and was therefore considered important. Although this condition has been around for a while, relatively little is known about it. At this time the best preventative measure against FAS is alcohol abstinence during pregnancy.

Fetal Alcohol Syndrome (FAS) and Fetal Alcohol Spectrum Disorders (FASD) affect approximately 50,000 children each year (Rutherford, 2001), between 5,000 and 12,000 in America alone (Onhealth, 2000), which is about 6% of children born to alcoholic mothers (Chen, Wilkemeyer, Sulik, & Charness, 2001). These disorders cause many deficits, which are physical, cognitive, and behavioral. For example, studies have shown that approximately 80% of individuals with FASD are not able to live independently (Autti-Ramo, 2000). They also lead to an economic cost of approximately $1.8 million per child (Chen et. al., 2001), a cost to the United States ranging from $75 million to $9.7 billion (American Academy of Pediatrics, 2000), not including lost productivity, as well as a social loss. The prevalence of the FASD is difficult to measure but one study examined different geographical locations and made some comparisons. The study found that in Seattle 1% of children were born with FASD and in South Africa the number was 4.8% (Lockhart, 2001). It is also difficult to determine exactly how much alcohol it takes to cause damage to a fetus, due to other factors having an impact (Rutherford, 2001). Some of these factors include maternal genetics, smoking, other drug use, physical illnesses during pregnancy, poor nutrition, trauma, stress, age, and having borne other children with FASD (Lockhart, 2001; Zevenbergen & Ferraro, 2001). When examining the profiles of mothers that had given birth to children with FAS and FASD, it was discovered that the “high-risk group was diverse in racial, educational, and economic backgrounds, however, most were victims of abuse and challenged by mental health issues’’ (Astley, Bailey, Talbot, & Clarren, 2000).

Multiple studies have been conducted in order to better understand the causes and effects of alcohol-induced disorders, as well as to determine the best course of treatment for the victims. Studies have shown that the longer the exposure to alcohol, the poorer the outcomes (Autti-Ramo, 2000; Zevenbergen & Ferraro, 2001). One study used 82 kids divided into 3 groups; heavy alcohol use during the first trimester, heavy alcohol use during the first and second trimesters, and heavy alcohol use
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during the entire pregnancy. A
majority of the participants were
followed up with multiple times
at different ages during
development. The final follow-up
was at age 12. The results showed
that more kids from Group 3 had
worse behavioral problems and
more concrete diagnoses of FAS
and fetal alcohol effects (FAE),
and sought professional help,
than the other two groups. The
researchers of this study
indicated that the behavioral
problems seemed secondary, due to
an increased susceptibility
cased by the brain damage. They
also discussed the possibility of
preventing behavioral issues with
appropriate support from birth
(Autti-Ramo, 2000).

Other research has focused on
the physical and biological
causes of the FASD. Because
alcohol passes easily through the
placenta and remains longer in
the fetus, than in adults.

Diagnosis

There are many different
alcohol related disorders. The
most severe is the FAS, which
consists of a majority of the
physical, cognitive, and behavior
deficits criteria, which will be
discussed later in further
detail. FAE is a less severe type
of FAS and generally lacks the
facial abnormalities (Lockhart,
2001; Mattson, Schoenfeld, &
Riley, 2001). FASD refers to a
continuum of all alcohol-induced
disorders (Lockhart, 2001). PEA
refers to Pre-natal Exposure to
Alcohol (Mattson, Schoenfeld, et
al., 2001).

Many researchers and health
professionals utilize four
criteria to determine FAS as well
as FASD; maternal drinking,
facial abnormalities, growth
retardation, and brain damage
(NIAAA, 2000). Other criteria
have been determined as well when
dealing with these disorders. The
Institute of Medicine (IOM)
developed 5 categories of alcohol
related disabilities: FAS with
confirmed maternal alcohol
exposure and characteristics,
such as facial abnormalities,
growth retardation,
neurodevelopmental disabilities,
and structural brain
abnormalities, FAS with the same
criteria as the previous, without
confirmed maternal alcohol
exposure, partial FAS with
confirmed maternal alcohol
exposure and some of the above
characteristics and behavioral
abnormalities that cannot be
explained by family or
environmental factors, alcohol-
related birth defects (ARBD)
which is indicated by
malformations or congenital
anomalies, and alcohol-related
neurodevelopmental disorder
(ARND) in which there is CNS
abnormalities that cannot be
explained by familial or
environmental factors (Lockhart,
2001).

The impact of FASD affects
different factors of an
individual’s life and present
themselves through multiple signs
and symptoms. These factors can
be examined in three different
areas; such as physical,
cognitive, and behavioral/social
deficits.

Physical

Most often, FAS and other
FASD are marked by a low birth
weight, small head circumference,
developmental delay, organ
dysfunction, facial abnormalities
(smaller eye openings, flattened
cheekbones, and indistinct
philtrum), and epilepsy
(Rutherford, 2001; Zevenbergen &
Perraro, 2001; NIAAA, 2000).
However, research shows that the
use of characteristic facial
features of FAS may not be very
reliable for diagnosing newborns.
This is because the deformities
sometimes occur normally in
newborns. Because doctors are
aware of this fact, often, only
the most severely deformed
children will be diagnosed, while
the others remain undiagnosed
A study was conducted to assess the ability of medical providers, which had not been previously trained, to accurately diagnose FAS through photographs. Overall, the identifications were accurate and enhanced when more information such as maternal drinking and birth weight were given. The race of the child did affect accuracy in that the African American children were incorrectly diagnosed as having FAS. The study indicated that doctors were able to identify the facial characteristics, however, only photographs of healthy children and those diagnosed with FAS were used, whereas other birth defects weren’t (HSS, 1998).

It has been noted that the more severe the physical characteristics are in a child, the worse the cognitive deficits (Onhealth, 2000). Researchers point out that it is important for professionals diagnosing craniofacial formations, to consider racial/ethnic differences (Zevenbergen & Ferraro, 2001). For example, underdevelopment of the midfacial region is normal in Native Americans, as are broader lips which may hide the thin upper lip in African Americans, and the tall stature in northern Europeans and central Africans which may obscure growth deficiency (HSS, 1998).

In order to determine indicators that could be used to identify FAS early on, a study was conducted. It examined both infants that had been exposed to alcohol and infants that hadn’t been, that had similar low birth weights, as well as the characteristic head circumference. It also measured a maternal report of drinking and scores on a cumulative risk index of maternal characteristics. The infants from both groups were matched for demographics. The researchers evaluated the children at birth, 6 months and 12 months, using neurodevelopmental growth, as well as the mothers utilizing questionnaires. There were significant findings in the behavioral and neurodevelopmental status as well as the head circumferences. Maternal reports of drinking were different over time and therefore proved to not be an effective measure of deficits (Coles, Kable, Drews-Botsch, & Palek, 2000).

Besides overt physical deformities, there are internal ones, especially in the brain. Researchers had originally found that the brains of those inflicted with FASD had an overall smaller mass. This leads to questions about the brain was proportionately smaller, or if it was smaller due to specific areas not being developed. A few studies have examined four main areas, the basal ganglia, the corpus callosum, the cerebellum, and the hippocampus. The results yielded significant results of malformations or underdevelopment in these areas. The basal ganglia, which controls motor abilities and cognitions, is smaller because of the reduced size of the caudate nucleus which controls the cognitive functions. The corpus callosum, or the nerves that connect the two hemispheres of the brain, appears thin or even absent, especially in the front (genu) and back (isthmus and splenium). This would cause deficits in attention, IQ, reading, verbal memory, executive functioning and psychosocial functioning. The cerebellum controls motor and cognitive skills, learning, balance, and coordination, and was found to be overall smaller than average brains, especially in one area, the anterior cerebellar vermis. The hippocampus, which controls memory, seemed to be the least affected, however, was found to
be smaller in the left temporal than in the right (Mattson, Schoenfeld, et al, 2001; NIAAA, 2000).

In order to identify brain deficits, many different types of tests are used. Brain imaging can be used to determine functioning levels in the brain. Using an EEG, which measures the electrical activity in waves, researchers found that individuals with FAS had reduced alpha waves at relaxation and during stimulation showed delays. The PET monitors specific regions of activity with images of metabolic or physiologic processes such as blood flow or sugar breakdown. With this test, the brains showed less activity. The SPECT is similar to the PET, and when studied, showed a similar level of activity in both hemispheres instead of more activity in the left than right during rest, as would be seen in non-alcoholic exposed brains (Mattson, et al., 2001).

Cognitive
The cognitive abilities of children with FAS and other FASD seem to be the area most affected. Some of the deficits include, poor coordination/ fine motor skills and speed, poor visual-motor integration, lack of imagination or curiosity, learning difficulties, inability to understand concepts such as time and money, poor problem solving skills, poor language comprehension, difficulty with executive functioning such as planning, difficulty with concept formation, and poor memory. There is also a lack of cognitive flexibility, selective inhibition, and reasoning (Rutherford, 2001; Lockhart, 2001; Zevenbergen & Ferraro, 2001; NIAAA, 2000).

There has been a lot of research in the area of cognitive deficits due to the huge impact it has on the quality of life of an individual. So many factors can be examined in order to give professionals better insight into FASD. One such study was conducted on acquisition (learning) and retention (memory) of non-verbal and verbal information. Two groups were used, the alcohol exposed and the non-exposed. The study administered multiple tests of both verbal and non-verbal information. The results showed that the exposed children learned less and reached the learning plateaus earlier than the non-exposed. It also demonstrated that exposed children benefit to repeated exposure to information (Mattson & Roebuck, 2002). There have also been studies that show memory deficits aren’t as global as once thought and only certain aspects of memory are affected, such as the implicit memory, as well as executive functioning deficits aren’t related to overall IQ (Mattson, et al., 2001).

Because of similarities, FAS, ADHD, and learning disabilities (LD), have also been compared to determine if and to what extent, differences exist. Studies have determined that differentiating between FAS and LD is difficult due to a lack of clarity in the diagnostic criteria for LD. However, research has discovered that individuals with FAS and ADHD differ in that those with ADHD have difficulty focusing and sustaining attention, while those with FAS have difficulty encoding and shifting attention to a different task (Lockhart, 2001). While at times FAS may easily be misdiagnosed as ADHD by accident, some professionals admit to purposely misdiagnosing due to a lack of appropriate special education, as well as insurance reimbursement for necessary treatment (Zevenbergen & Ferraro, 2001).
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Behavioral / Social

Children with alcohol related disorders often exhibit behavioral problems and poor socialization skills, such as hyperactivity, an inability to concentrate, social withdrawal, stubbornness, impulsivity, and anxiety (Rutherford, 2001; Zevenbergen & Ferraro, 2001; NIAAA, 2000). They also exhibit an inability to control anger and frustration, as well as not being able to understand the motives of other people (Onhealth, 2000). However, in some cases, the deficits manifest themselves more severely as bullying, lying, stealing, cheating, shoplifting, increased school suspensions or drop-outs, substance use, or inappropriate sexual behaviors (Zevenbergen & Ferraro, 2001).

One study examined the idea of exposure to alcohol in utero causing an increase in likelihood of later substance use or abuse. In an attempt to decrease environmental confounding variables, the study examined children that had been adopted. The children, both high risk (exposed) and low risk, were ages 18-45. The current levels of drug use were measured as were environmental factors. The researchers found that FAS does increase possibility of future drug, alcohol, or tobacco use, however, it may not be the only factor due to other poor health practices possibly occurring during pregnancy (Yates, Cadoret, Troughton, Stewart, & Giunta, 1998).

Another study examined youth involved in the criminal justice system. Learning and behavioral disabilities, often lead to poor judgment, impulsiveness, and an inability to anticipate consequences, which may lead to maladaptive and criminal behaviors. The study was conducted on youth at an Inpatient Assessment Unit of Youth Forensic Psychiatric Services. They were aged 12-18 and had been found guilty of an offense. The results were significant in that of 287 youth offenders, 67 had alcohol related disorders. Three had a diagnosis of FAS, while 64 had a diagnosis of FAE (Fast, Conry, & Loock, 1999).

There may also be psychiatric consequences for individuals with FASD. The most common psychiatric disorders seen in these individuals are attention disorders, depression, suicidality, panic attacks, and hallucinations (Lockhart, 2001). Also recorded are eating and sleeping disorders, toileting problems, and phobias (Zevenbergen & Ferraro, 2001).

Some researchers believe that FASD are under-diagnosed due to no definitive diagnostic tests to identify FASD existing. Instead, much criteria relies on reports from the caregivers and physical characteristics (Onhealth, 2000). Besides observing physical characteristics and behaviors, there are some assessment tools used. Assessment tools for neonates measures arousal, habituation, and motor tone. In school-age children, it is recommended that the researcher uses the WISC, WPPSI, and evaluates classroom behavior through reports. There is little known about the best way to evaluate adolescents and adults, except to examine functional skills, social problem solving, and vocational skills (Zevenbergen & Ferraro, 2001).

Recently, a new tool, the Fetal Alcohol Behavioral Scale (FABS), was developed. It contains 36 items in which the caregiver provides information. Studies have shown great success with the tool (Zevenbergen & Ferraro, 2001). NIAAA also developed two guides for screening and intervention. One is for the pregnant woman, the other for the infant (NIAAA, 2000).
Children with FASD are often misunderstood and looked at as unintelligent or problem children (Rutherford, 2001). Because many children aren’t properly diagnosed early enough, they don’t receive the treatment or services they need. The earlier the child is diagnosed, the better the chances are for living a more fulfilling life. There are signs that are noticeable, for example, within the first few days after birth, children not yet diagnosed with a FASD display decreased arousal to stimulus, unusual reflexive responses, slower information processing, fine motor dysfunction, irritability, sleep problems, feeding difficulties, restlessness, and quick startle response. Also, at pre-school age, these children show delayed speech, lack of stranger anxiety, poor attention, and hyperactivity (Zevenbergen & Ferraro, 2001).

**Treatments**

Prevention should be the first line of defense in the battle against FAS and other FASD. Many researchers believe that information about alcohol related birth defects should be added to all educational curriculum, starting in elementary school (American Academy of Pediatrics, 2000). Although abstinence from alcohol should be the only pre-birth treatment needed, scientists are developing ways of preventing the alcohol from damaging the fetus. In mouse embryos, Octanol and other non-beverage alcohol molecules have been found to block ethanol’s effects on the cell attachment process, therefore preventing fetal alcohol syndrome (Wilkemeyer et. al., 2002; Chen et. al., 2001).

Research shows that 2 protective brain protein peptides, NAP and SAL, also protect mouse embryos from fetal damage (Wilkemeyer et. al., 2002). Another study was conducted to determine if NAP and SAL protect in the same manner that octanol does. The results were significant for similarities, especially the NAP (Wilkemeyer et. al., 2002). It has also been found in animal experiments, that by restoring the balance of substances affected by alcohol with antioxidants, cell damage caused by free radicals may be prevented (NIAAA, 2000).

However, if prenatal prevention of FAS or other FASD doesn’t occur, there is no post-birth cure. At this point, treatments available are techniques that have been found to best manage the disorder. As with many illnesses, early detection and intervention are important factors for a good prognosis. Especially since research has shown that symptoms may intensify when the person grows into adulthood, leading to mental illness, legal issues, and an inability to live independently (Rutherford, 2001). Researchers that have used longitudinal studies have discovered that development and stimulation programs begun between birth and age 5 have made enormous differences (Rutherford, 2001).

As with many cognitive disorders and mental illnesses, multi-level treatment is the best. Some approaches include using psychopharmacological medications, behavioral therapy, receiving proper educational placement, obtaining speech and language services, occupational therapy, having direct advocacy, using parental supports and education, social services supports, and vocational services (Lockhart, 2001). The use of stimulant medications has been found to reduce hyperactivity and inattention. This population also needs proper medical treatment for eye problems, eating
problems, and dental needs (Zevenbergen & Ferraro, 2001).

In addition to utilizing one of the many forms of management or treatment, it is also important for the individual to continually have assessments to ensure that the proper services are being rendered. It has been suggested by researchers that assessment tools should measure concrete rather than abstract knowledge and begin with easy questions to build confidence. It is also important that the test-giver maintain visual attention with the individual when speaking, administer difficult tests in the middle before the individual becomes tired, know the test well so as to not lose the individuals attention, provide an environment with minimal distractions, and provide breaks when needed (Zevenbergen & Ferraro, 2001).

It has been found that when working with children, effective techniques include: small group activities, breaking up large tasks into smaller tasks, using visual aids, repeating information, using simple concrete instructions, emphasizing communication, using consistent punishments when needed, and allowing for breaks when needed (Zevenbergen & Ferraro, 2001). Adults could also benefit from those conditions, however, it is very important to focus on functional skills (ie. balancing a checkbook or grocery shopping), present and future environments (to help adaptation skills), and work areas being kept clear and free of distractions. Both adults and children also benefit from consistent routines (Zevenbergen & Ferraro, 2001).

Discussion

As research has shown, there are many debilitating consequences that can follow prenatal exposure to alcohol. These deficits, physical, cognitive, and behavioral, have a severe impact on the life they affect. Continued research in this area will help professionals to better understand the individuals afflicted with the disorders as well as develop more treatments. It was interesting to find that with all the research that has been done on FAS and FASD, most articles are repetitive. While it is important to continue studying ways of diagnosing the condition and relating the on-going changes in terminology and criteria, it is also important to study different effects that FAS and FASD has on the individual’s life and functioning, as well as on the effects on society.

One such area, in which more research should be conducted, is in the impact of FASD on criminal activity. This is important because as previous research has shown, many individuals in this population have impulse control as well as an inability to determine consequences. Therefore, many more crimes may be preventable if it is found that a high percentage of criminals are diagnosed, or should be diagnosed with FASD, and proper treatment is administered. The information on better testing techniques for assessments could also be used in the academic setting for school learning and tests. By helping the children do better in the academic setting, it will increase their functional skills and social, as well as their self-confidence, therefore, keeping them integrated in society. When individuals learn how to adjust to their disabilities within their society, it offers them a better, more fulfilling life to lead, instead of creating outcasts. It is also important to continue developing more effective prevention programs. As was mentioned earlier, prevention should be started in school
health classes as early as elementary school. This would not only be a good preventative measure, but it would also expose children to the effects, which may decrease discrimination against those inflicted. Another possibility would be to increase doctor-run programs for women looking to become pregnant as well as those that test positive for pregnancy. Even with all the treatments and techniques for managing FASD, prevention through pre-natal alcohol abstinence, pre-natal programs and education, and doctor cooperation, is the best choice to ensure a healthy child. (Rutherford, 2001), disruptions in cell and neural development occur. It has been found that alcohol interferes with the adhesion molecules which prevents crucial cell to cell attachments which form to become the brain and central nervous system (Wilkemeyer, Menkari, Spong, & Charness, 2002). Not only are the cells unable to connect, but alcohol can also cause apoptosis, or cell death, which causes reduced brain mass and leads to many difficulties including neuropsychiatric problems (Lockhart, 2001). No research so far has found any paternal link between drinking patterns and the birth of a child with FASD (Onhealth, 2000).

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