

Alcohol Consumption During Pregnancy

Alcohol exposure is the most preventable cause of birth defects and developmental disabilities in the U.S.^{4,5}



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What are fetal alcohol spectrum disorders (FASD)?

Fetal Alcohol Spectrum Disorders (FASD) is an umbrella term referring to the range of outcomes that can result from fetal exposure to alcohol.¹ To a developing fetus, alcohol is a teratogen that can have deleterious effects on its development.¹ Most devastatingly, FASD can cause brain damage that results in behavioral, motor, and cognitive dysfunction.²

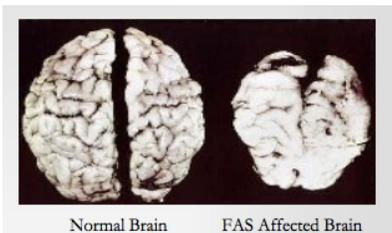
FASD itself is a non-diagnostic term, but it refers to 4 diagnostic categories. The 4 categories, ranging from most severe to least severe, are: 1) fetal alcohol syndrome (FAS), 2) partial FAS, 3) alcohol-related neurodevelopmental disorders (ARND), and 4) alcohol-related birth defects (ARBD).³ FASD also includes spontaneous abortion or sudden infant death if related to alcohol exposure.¹

How are FASD diagnosed?

Diagnostic schemas for FAS include abnormalities in the following 3 areas:¹

1. Pre- and/or postnatal weight or height at or below the 10th percentile.

Figure 1. An FAS-affected brain vs. a normal brain.⁷



Normal Brain FAS Affected Brain

2. Central nervous system dysfunction, defined as evidence structural brain abnormalities, head circumference below the 10th percentile, or evidence of CNS dysfunction.
3. Characteristic facial features, the most distinctive of which are a thin upper lip, a smooth philtrum, and narrow eyes.¹

Expert recommendations



“CDC urges pregnant women to not drink alcohol any time during pregnancy.”⁶



“The American Academy of Pediatrics recommends that women who are pregnant, or who are planning to become pregnant, abstain from drinking alcoholic beverages of any kind.”¹³



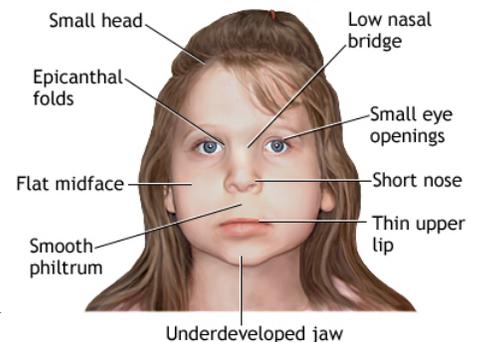
“Women should avoid alcohol entirely while pregnant or trying to conceive.” – The American College of Obstetricians and Gynecologists ACOG.¹⁴



“The committee recommends that...pregnant women and those about to become pregnant be counseled to avoid alcohol consumption throughout pregnancy.” – The Institute of Medicine¹⁵

Healthy People 2020 goal: “Increase abstinence from alcohol among pregnant women.”¹⁶

Figure 2. Typical FAS facial features.⁸



Diagnosing FASD is challenging

Despite the clear diagnostic criteria, diagnosing FASD can be very difficult. Many affected children, specifically those without full FAS, do not display the facial abnormalities. For those who do, the features can be harder to detect as children age.^{9,10} A behavioral phenotype specific to FASD has not been identified, making FASD children hard to distinguish from those with ADHD or another disorder with similar behavioral outcomes.⁹ Furthermore, confirmation of maternal drinking during pregnancy is often lacking,⁹ and many physicians report feeling unprepared to identify and diagnose FASD.¹¹ For these reasons, many cases of FASD go undiagnosed, preventing FASD individuals from accessing much-needed support services.¹⁰

What are the impacts of FASD on the child?

Alcohol primarily affects the nervous system, and thus its effects on behavior and cognition are numerous. A literature review conducted in 2011 by Mattson and colleagues summarized the effects of prenatal alcohol exposure (PAE) in the following areas:¹⁷

- **Intellectual capacity.** The average IQ for people with heavy alcohol exposure is 70, which is generally indicative of mild mental retardation.¹⁸ For individuals without facial abnormalities, the average is closer to 80.
- **Executive functioning.** Children with PAE demonstrate impairments in problem solving and planning, forming and shifting concepts, thinking abstractly, verbal fluency, response inhibition, and working memory.
- **Verbal and non-verbal learning and memory.** Children with PAE show a reduced ability to learn new verbal and non-verbal information, but some studies have shown that they have a preserved ability to retain information once learned.
- **Language.** Children with PAE have difficulty with speech production and expressive and receptive language skills.
- **Motor function.** Children with PAE display deficits in fine and gross motor function, though studies are inconclusive as to whether or not these deficits persist into adulthood.
- **Attention.** Children with PAE demonstrate decreased functioning with respect to vigilance, reaction time, and information processing. Studies suggest that visual attention may be more impaired than auditory attention.
- **Psychopathology.** Children with PAE are more likely to be impulsive, delinquent, and have higher rates of internalizing and externalizing behavior disorders. They also have higher rates of co-morbid psychiatric disorders.

What are the impacts of FASD on the community?

Deficits in the areas described above translate into a reduced ability for FASD individuals to function normally and become productive community members. FASD individuals have increased risk for unintended pregnancy, substance abuse, difficulty in school, difficulty in employment, and problems with parenting.¹⁹ Sixty-one percent of adolescents and 58% of adults with FASD have been in legal trouble, and 35% of people over the age of 12 with FASD have been incarcerated at least once.²⁰ Furthermore, the costs associated with FASD are enormous: the U.S. National Task Force on FAS reported the annual cost of FAS in 2009 at \$3.6 billion, with costs for FASD being much higher.¹ Experts have estimated the lifetime cost of caring for an individual with FAS at \$2 million.²¹

What are risk factors for developing FASD?

A minority of pregnant women who drink heavily will have babies with FASD.² Known risk factors for having a baby that develops FASD given heavy alcohol consumption are:

- ❖ **Maternal age.**^{3,24} Among women drinking 5 or more drinks at least weekly, fetal functional impairment is 2-5 times more likely among mothers 30 or older.²⁴
- ❖ **Low socio-economic status.**^{3,24} This is likely due to an interaction of poor nutrition, genetics, social issues, and intergenerational maternal alcoholism.²⁴
- ❖ **Concurrent use of tobacco, marijuana, or cocaine.**²⁴ Use of these substances may increase free radical formation and reduce levels of certain nutrients.
- ❖ **Maternal and fetal genotype.** Mothers and infants with less efficient alcohol dehydrogenase enzymes may be more at-risk for the development of FASD in the fetus.²

How does ethanol affect the fetus?

Alcohol primarily impacts fetal development via the following 3 mechanisms: 1) disruption of gene expression, 2) interference with signals that control cell survival and/or cell death, and 3) disruption of synaptogenesis.²

Alcohol can also have detrimental effects by generating reactive oxidative species, which have been implicated in neurodegenerative diseases.²

Brain images support the idea that alcohol interrupts normal synaptogenesis and synaptic pruning.²⁵ Brain scans of control children show significant brain growth from around age 5 to age 10, and then a significant decrease in brain volume from age 10 through age 20 due to synaptic pruning and myelination. The brains of children exposed to heavy *in utero* alcohol exposure, however, only decrease in volume starting at age 5 due to reduced brain plasticity. Reduced brain plasticity is related to lower IQ and more severe facial dysmorphology.²⁵

Prevalence of FASD and drinking during pregnancy

7.6% of pregnant women consume alcohol, which means that 1 in 13 babies are at risk for FASD.²² Prevalence of binge drinking among pregnant women in 1.4%.²²

Recent studies estimate that 2-5% of school children in the U.S.³ have FASD. Each year, as many as 40,000 babies are born with FASD and 8,000-28,000 with FAS.^{4,12}

Challenges conducting studies on fetal alcohol exposure

Studies evaluating the effect of maternal alcohol consumption on the fetus are notoriously difficult to conduct. Alcohol affects a range of outcomes in the fetus and child, and thus it is nearly impossible to conclude no effect of alcohol with certainty.³³ Further, women are likely to underreport their alcohol consumption due to social desirability or recall bias,³³ and it is difficult to identify and measure all confounders.³⁴ In previous studies, researchers have not used the same criteria for classifying light, moderate, and heavy alcohol exposure, and they have also not adjusted for the same confounders.³³

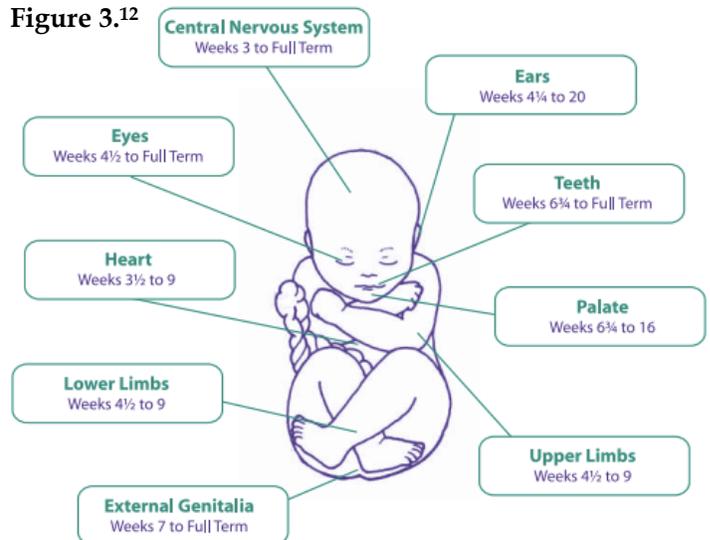
Why are the effects of ethanol so detrimental?

Every time a pregnant mother has a drink, her baby does too.⁶ Alcohol passes through the placenta via the umbilical cord, and within 1 minute, ethanol can be detected in the fetus.^{4,6} The fetus' blood alcohol level then rises to nearly equal the mother's.⁴ Unlike its mother, however, the fetus has an extremely limited capacity to metabolize ethanol. The fetus has a metabolism that functions at 10-15% of adult capacity, and the enzyme responsible for 90-95% of alcohol metabolism in the fetus does not appear until the fetus is 2 months old.⁴ The remaining 5-10% of the ethanol may leave the fetus through renal or pulmonary excretions; however, ethanol excreted in the manner simply accumulates in the amniotic fluid that envelops the fetus (see Figure 3).⁴ The fetus may then ingest the ethanol again, either through swallowing or diffusion across its external membrane.⁴ Consequently, a fetus' blood alcohol level remains high long after its mother's levels have returned to normal.¹²

What is the effect of timing of alcohol exposure?

The impact of alcohol exposure on fetal organs depends on the time of exposure relative to the period of organ development.² Figure 3 depicts the key development periods of various fetal organs and body parts. It is critical to note that drinking during any trimester can negatively affect the fetus' central nervous system, which can have extremely deleterious impacts on later functioning.⁶ It is possible that the central nervous system is most vulnerable during the first trimester, though more research is needed to confirm this.²⁵ Moderate to heavy drinking during the first trimester does put the baby at heightened risk for having abnormal facial features,⁶ as well as depression and anxiety.²⁶ One study showed that moderate to heavy drinking during the third trimester increased odds of aggressive behavior.²⁶

Figure 3.¹²



What are the primary strategies for reducing alcohol-exposed pregnancies?

Strategies to reduce alcohol-exposed pregnancies focus on decreasing drinking among not only pregnant women but also all women of childbearing age, given that half of pregnancies are unplanned.²⁷ Previously, universal prevention strategies have sought to increase awareness of the risk of drinking during pregnancy through mass media campaigns, educational materials, and policy requiring alcohol beverage labeling.²⁷ An example of a clinical universal prevention strategy is the CDC's Project CHOICES. The intervention consists of 2-4 motivational interview sessions and 1 session on contraception with women who are not yet pregnant.^{5,28} Project CHOICES has been shown to significantly reduce risk of alcohol-exposed pregnancies.⁵ Targeted intervention strategies for pregnant women who consume alcohol are also critically needed. In 2001, a literature review of 22 studies found that brief motivational interviewing in the clinical setting can be effective at helping pregnant women reduce their drinking.²⁷ More recent studies have confirmed this.^{29,30} The National Task Force on Fetal Alcohol Syndrome and ACOG support universal primary care screening of pregnant women for alcohol use, brief motivational interviews, and referral to treatment for high-risk women.^{27,31}

What are the primary strategies for caring for individuals with FASD?

- ❖ **Supplements:** Maternal supplements during pregnancy may mediate the impact of alcohol exposure. Such supplements include antioxidants, which limit the development of reactive oxygen species,² and choline.^{10,21}
- ❖ **Behavioral interventions:** Results from animal studies suggest that environmental enrichment and motor training in FASD children can correct some of the negative effects of alcohol due to neural plasticity.^{2,19} In school, special education classes can be very helpful for FASD children, as well as one-on-one tutoring.³²
- ❖ **Stable relationships:** A caring home environment that lacks violence and harmful relationships is especially important for youth with FASD.⁵ Research has demonstrated the specific importance of a stable relationship between the mother and child.²¹ Educational therapies exist for training FASD children how to make and interact with friends; trainings also exist for teacher parents how to effectively parent their FASD child.³²

The effect of light alcohol consumption on child outcomes.

While the negative effects of heavy alcohol consumption on the fetus are clear, the impact of light alcohol consumption has been equivocal. Studies in the past 5 years have demonstrated a positive impact, a negative impact, and no impact at all of light alcohol consumption during pregnancy.³⁴ A 2012 literature review conducted by O'Leary and colleagues, however, found that studies reporting a significant of light alcohol consumption on the fetus (whether positive or negative) had significant methodological flaws.³³ Methodologically sound studies found no effect of light alcohol consumption on the fetus. Findings from this review are corroborated by 2 recent prospective cohort studies.^{35,36} **However, recent studies have demonstrated in increased risk of neurodevelopmental disorders after only 30-40g of alcohol in one sitting and 70g per week, which equates to about 2 servings of wine or beer weekly.**³³ Therefore, there is only a small margin of error before risk to the fetus is increased.

Why many women are confused about whether or not drinking is safe.

In the past decade, the United States, Australia, the United Kingdom, have changed their stance on alcohol consumption during pregnancy from a tolerance of light drinking to support of total abstinence. Further, messaging from health care providers is often inconsistent or absent messaging. In one study, 37% of women were not told anything about drinking during pregnancy from their health care provider and 3% were told that it is okay.⁴⁰ In a survey of 879 American Academy of Pediatrics members in the U.S., 16% reported that occasional drinking during pregnancy is safe.¹¹ Messaging content and delivery must be consistent in order for pregnancy women to adhere to best practices.

What important issues remain to be addressed?

Further research is needed to determine whether or not there is an alcohol consumption threshold below which there is not harm to the fetus, as well as to delineate the full range of outcomes associated with FASD.¹⁹ Furthermore, research is needed to identify a "behavioral profile" for children exposed to alcohol.¹ Lastly, we need to better understand why only some babies get FASD given high alcohol exposure.

In terms of treatment for FASD, we need increased training of health care professional of how to identify, diagnose, and coordinate treatment for children with FASD,¹¹ as well as more comprehensive and accessible care for children with FASD.¹⁹ Additionally, we need more accurate and discriminant ways of diagnosing children who have FASD. Early identification of FASD and understanding of the level of impairment is critical for effective treatment.¹ To reduce the prevalence of alcohol-exposed pregnancies, implementation of universal alcohol screening among pregnant women is needed in the primary care setting,²⁷ as well as consistent message around abstinence.^{11,33}

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