When a pregnant woman drinks alcohol, within minutes the blood alcohol level in the fetus becomes about the same as that in the mother. The embryo and fetus are growing and changing so rapidly that their development can be altered by exposure to certain toxic drugs, like alcohol. Amounts of alcohol that have no perceptible long-term effect on the mother can produce long-lasting effects on the offspring.

The birth defect cause by heavy prenatal exposure to alcohol in utero is called Fetal Alcohol Syndrome (FAS). FAS is the most common known cause of mental retardation in the western world. Yet FAS is entirely preventable.

Lemoine, a French pediatrician, noted a characteristic appearance and behavior among children of alcoholic mothers. He concluded in a 1968 paper that the characteristics were so distinctive that alcoholism in the mothers could be diagnosed by observing the children. In 1973 Jones, Smith, and colleagues independently made similar observations and termed this characteristic pattern of physical abnormalities Fetal Alcohol Syndrome. Since then, hundreds of reports of patients from all racial groups have been published.

Fetal Alcohol Syndrome (FAS) is a specific birth defect manifest by a cluster of specific features in each of three categories: (1) facial abnormalities; (2) growth deficiency; and (3) central nervous system effects.

The facial abnormalities include a cluster of characteristics: small eyes; thin upper lip; flat midface; short upturned nose; small chin; other eye problems, including drooping eyelid and crossed eyes; and some minor abnormalities of the external ear. Not all of these are found in all cases of FAS, and the individual characteristics have no diagnostic significance when found in isolation. A higher frequency of major congenital malformations (heart defects, cleft lip and palate, and so forth) occurs in children with FAS, but no particular major malformation is necessary for the diagnosis. Malformations of the fingers, toes, and other joints and limbs also occur with increased frequency. Auditory problems (primarily inflammation of the ear) and vision problems (primarily nearsightedness) are also frequently observed, along with malformed and misaligned teeth.

Growth deficiency for height and/or weight is present at birth and continues during childhood. The low birth weight and short birth length show a direct effect of alcohol on fetal growth. Except in unusual circumstances the continuing growth deficiency is a permanent condition arising from the prenatal trauma, and usually not the result of postnatal nutritional status. Hormonal changes may result in weight gain among females, so the characteristic thin appearance may not be observed after puberty. Shortness of stature remains characteristic into adulthood in most patients.

Central nervous system manifestations usually include some degree of mental handicap, ranging from mild to severe. Small head circumference is usually present and it reflects smaller brain size. Large head circumference may be present. In infancy, tremulousness and jitteriness, poor sucking reflex, high or low muscle tension, and/or delayed development are often observed. Childhood manifestations include hyperactivity, short attention span, borderline to moderate mental retardation, and/or learning and behavioral problems.

Certain postpubertal changes should be considered in diagnosing FAS in adolescents and adults.
After puberty the general appearance may not be as striking. Growth of the nose and chin may increase; growth deficiency for weight may no longer be relevant (particularly in females), although small head circumference and/or short stature may remain as markers. Hyperactivity and short attention span may become less prominent, although specialized memory deficits, difficulty with adaptive behavior, and poor judgment become increasingly noticeable.

In general, the older the child, the less distinguishing are the physical features associated with FAS. Diagnosis is easiest within the first two or three years of life. Not all newborns are readily diagnosed, although by eight or nine months the diagnostic picture is usually clear.

FAS, or the effects of prenatal alcohol in general, do not diminish as the child grows older. Different aspects, however, are conspicuous at different ages. The newborn shows effects on growth and development and subtle central nervous system abnormalities. During the pre-school years, hyperactivity and language and motor problems are noted. The school-age years show learning and behavior problems, and attentional and memory deficits. In adolescence psychosocial problems and aggressive anti-social behavior are often observed. Adults exhibit difficulties with adapting and self-sufficiency. Intellectual difficulties associated with FAS remain fairly constant into adulthood in most patients.

Fetal Alcohol Effects (FAE) is a term used when a child has had prenatal alcohol exposure and some characteristics of FAS, but not enough for diagnosis of the full syndrome. FAS is clearly defined and known to be caused by heavy in utero alcohol. FAE covers a wide range of disabilities and aberrations from which prenatal alcohol exposure can only be inferred. With FAE, symptoms are less specific to alcohol. The impact on the child can be just as debilitating whether the diagnosis is FAS or FAE. All such children should be considered at risk for developmental problems, particularly at key ages such as the onset of normal schooling, the onset of puberty, and the end of formal schooling. Although children diagnosed with FAS, as a group, have lower IQ scores than those with FAE, they may be equally at risk as adolescents and adults for learning disability, behavioral problems, mental illness, and psychosocial disorders as adolescents and adults.

Children with the full FAS are usually born to women who clearly consumed a lot of alcohol during program. One problem with research on the effects of alcohol on the fetus, however, is that assessment of exposure comes primarily from self-report.

The duration of maternal alcoholism is highly related to severity and frequency of FAS among offspring. Women are more vulnerable to alcohol than men, developing cirrhosis and dying from alcoholism after fewer years of and much less lifetime alcohol consumption. Gynecologic problems increase with increasing drinking levels. Miscarriage or stillbirth, premature birth, birth defects, and infertility are all associated with higher levels of alcohol consumption.

Prenatal alcohol exposure is associated with a continuum of risks. At the heaviest exposure end are children who are clinically abnormal and diagnosed FAS. At the lighter end effects may not be observed in individual offspring but are detected by epidemiologic studies of more or less normal individuals in population-based studies.

Amounts of as low as two drinks per day increase risk of spontaneous abortion, lowered birth weight, and neurobehavioral effects on offspring as old as seven years. Three or more drinks per day increase risk of stillbirths, reproductive system disordered, and neurobehavioral deficits.

One recent study shows an association between drinking one or two drinks per day during lactation and a decrease in psychomotor function in year-old babies, even after adjusting for variables. Advice to breast feeding mothers may also need to be modified.

Much information on long-term neurobehavioral effects of social drinking in pregnancy has come from the 15-year Seattle Longitudinal Prospective Study on Alcohol and Pregnancy. Starting on the first day of life, alcohol-related deficits were observed on neurobehavioral tests and on physical examination. Subtle alcohol-related decreases were also noted on mental and motor development at eight months. By four years statistically significant IQ deficits were observed, as well as decreases in fine and gross motor function (mostly balance), and sustained attention. Poor reaction time was one of the strongest deficits at the four-year exam.

Of course these studies do not indicate that drinking during pregnancy is the only cause of these outcomes. But after other known causes have been statistically adjusted for, prenatal alcohol exposure is clearly related to adverse outcomes.
exposure remains a significant predictor of later neurobehavioral effects in children. These studies on the children of social drinkers confirm that there is no known safe level of alcohol exposure in utero and no known safe time for exposure during gestation.

The prevalence of FAS is about one in 600 to 750 live births in studies conducted in northern France; Gothenburg, Sweden; and Seattle, Washington. The risk of FAE is about twice that of FAS.

The cost to the United State of Fetal Alcohol Syndrome has been conservatively estimated at $321 million per year for only some of the disabilities associated with it. Many patients with FAE are unable to live independent productive lives even though they may not technically be classified as mentally retarded. Current residential and support services for mentally retarded persons in the United States are about $11.7 billion per year; 11 percent of these costs are estimated to be from FAS alone. These are probably underestimates as the extent of disability in adolescents and adults with both FAS and FAE is only now being recognized.

In the Seattle Longitudinal Study on Alcohol and Pregnancy; "blind" clinical examinations were given to newborn infants whose mothers' alcohol use had been previously measured by self-report during pregnancy. The higher the mother's drinking during pregnancy, the higher the risk of having a baby with fetal alcohol effects (defined here as growth deficiency, small head circumference, and minor physical abnormalities). The risk for an offspring with FAE was 10 percent for those reporting one to two ounces of absolute alcohol per day, and 19 percent for those averaging over two ounces (over four drinks of wine, beer, or hard liquor per day, on the average).

At four years of age, children classified FAE at birth on these criteria had IQ scores over two thirds of a standard deviation (10.5 IQ points) below the rest of the sample after adjusting for other known influences on IQ in this population. These subtle newborn characteristics of FAE were good predictors of children who were clearly at risk for long-term neurobehavioral deficits. Irrespective of neonatal FAE characteristics, mothers who had three or more drinks per day on the average had children with an average of five IQ points lower than the rest of the group at four years. Mothers who reported a binge pattern of alcohol (five or more drinks per occasion) had more children at risk for learning disabilities. By the second grade of school, 24 percent of their children were already in special programs or classes, versus 14 percent for the rest.

The harm alcohol causes to the fetus has been established with hundreds of studies on laboratory animals where alcohol, as the primary cause, can be separated from the other factors that may vary with alcohol in the human condition and which in human studies must be statistically controlled. These include smoking, use of illicit drugs, poor nutrition, poverty, and adverse child-rearing conditions. Prenatal alcohol, in the absence of these variables, has been shown to produce growth deficiency, physical malformation, and disruptions in the central nervous system in a variety of animal species ranging from rodents to nonhuman primates. The studies of perhaps the greatest interest are those documenting alcohol-related disruptions in brain development in utero. Early work in this area documents alcohol-related disruptions in several regions of the brain. Several more recent studies extend this work to low-dose effects of alcohol, showing behavioral and neurochemical effects at doses too low to produce deviations in physical structure or growth that last well into adulthood. Noble reports evidence that prenatal alcohol exposure alters activity of excitatory amino acids (EAAs) in the brains of adult rats.

The behavioral problems observed in animal models of FAS may derive in part from brain disruption in utero, the lifetime consequences of which are played out as the offspring develop. A wide variety of lifetime behavioral deficits of the rat that are produced by prenatal alcohol exposure have been documented. These behaviors also observed in patients with FAS and/or documented in the Seattle social drinking study include: early sucking difficulty, weak reflexes, early gain problems, difficulty with response inhibition, increased activity, learning problems, and visual spatial problems. Animal and human studies how fairly good agreement with compared in terms of estimated blood alcohol levels (BALs), and both show a dose response relationship.

Other mechanisms that may show the harm alcohol causes to the fetus have included prenatal oxygen deficiency from alcohol-induced constriction of fetal circulation; alcohol-induced inhibition of essential amino acids across the placenta and blood/brain barrier; direct toxic effects of acetyl...
aldehyde or other or other primary metabolites of alcohol; disruption of prostaglandin synthesis; and/or disruption of the hypothalamic-pituitary-ovarian-adrenal axis.

The 1985 National Household Survey on Drug Abuse found that 89 percent of women in the childbearing years had had alcohol in their lifetimes, 61 percent in the past month. The 1987-88 National Adolescent Student Health Survey showed that 50 percent of 10th grade girls were using alcohol and 50 percent thought it was acceptable to have sex with a steady friend. In Seattle, recent studies at the University Hospital revealed that 52 percent of women had used alcohol during pregnancy and 13 percent had an alcohol use pattern involving five or more drinks per occasion.

Organized prevention activities are clearly warranted. The best start is a pronouncement from a country's public health officer, recommending that women abstain from alcohol during pregnancy and when planning a pregnancy.

The next step is to get that message to the entire community, not just pregnant women. Although it may be difficult for an individual woman on her own to overcome alcohol use, the support from family and friends can help her attain and maintain abstinence.

Strategies for raising public awareness about abstinence during pregnancy can include warning labels on alcohol beverage containers; signs at places where people purchase alcoholic beverages; brochures distributed throughout the community; continued media coverage; and a crisis line for information and referral. The crisis phone line become the link between the information transmitted in the public awareness campaign and the services available in the community. One without the other will not solve the problem.14,15

Increasing professional education about alcohol-related birth defects (ARBD) is another important activity. Medical schools, nursing schools, psychology departments, schools of education and social welfare, schools for public administration and policy all training programs for human services personnel should have specific curriculum materials on alcohol-related birth defects. But to prevent alcohol related birth defects, we will have to rely on a broader campaign than one just oriented to public health nurses, obstetricians, and mid-wives. It should be a community activity, and a broad range of community service professionals need to be trained at two levels: curriculum additions for those currently in training, and on-going in-service training for those who are already operating as professionals in the field.

Teachers without knowledge of FAS/FAE are often annoyed at the behaviors of such children in the classroom and frustrated by their inability to help them. When the cause of these problems is not recognized, they are often expected to perform to unrealistic expectations, often find school frustrating and unrewarding, often develop undesirable behaviors, and often end up dropping out of or being expelled from school. They are usually even less well-equipped for survival outside of school. Use of alcohol and other drugs and a life on the streets often awaits them once they leave institutional supports.

All women in prenatal care should be asked about their use of alcohol before and during pregnancy, told about the risks associated with such drinking, and advised to stop drinking. Although the best outcome is obtained by abstaining throughout pregnancy, stopping during pregnancy is related to better outcome than drinking throughout pregnancy.

Routine screening of all delivering mothers for alcohol use and of all newborns for FAE is extremely important to target these high-risk families. Appropriate services are needed not only for women who are using alcohol during pregnancy, but also for intensive post-delivery follow-up for mothers and babies. The range of services should include both inpatient and outpatient services, oriented to the special needs of alcohol-dependent women and dealing with the myriad of associated problems, including social support, financial support, self-image and job-skills training, as well as the obvious detoxification and alcohol treatment aspects.

Finally, it is important to properly educate learning-disabled individuals about ARBD and the risks of alcohol use and to provide concrete help with appropriate methods of birth control and treatment for alcohol and drug abuse problems, particularly among the handicapped. Pregnancy has been a frequently problem among adolescent girls with FAS. Although FAS is not genetically transmitted, it can occur successive generations when women who themselves have ARBD drink heavily during pregnancy, these developmentally-disabled mothers are clearly at high risk for parenting difficulties.
Safeguarding the future generation should be a primary goal for public health officials and for private citizens. Our children are our most precious resource.

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References