Alcohol

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been focused at the level of the individual.

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SECTION EDITOR'S NOTE. "First, take a deep breath." In the hospital, clinicians learn to run "stat" to treat status asthmaticus, but in the community, work moves at a different pace. It is remarkable how much these residents accomplished in 2 years. This was not the result of rushing into action, but of a deliberate process that began with forming relationships, identifying an evidence-based intervention, and building consensus among a wide variety of community partners.

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In Brief

Alcohol

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The discovery of late Stone Age beer jugs established that intentionally fermented beverages existed at least as early as the Neolithic period (circa 10,000 BC). Alcohols are hydrocarbons that have a hydroxyl (-OH) group attached. Ethanol is the alcohol found in alcoholic beverages. The most common toxic alcohols encountered clinically

that are not intended for ingestion are methanol and ethylene glycol. Another widely available alcohol is isopropanol, which is present in rubbing alcohol.

Alcohols are widespread throughout the environment. Ethanol is present not only in alcoholic beverages but also in mouthwashes, cough and cold preparations, elixirs, and perfumes. Methanol is found in such consumer products as windshield washer fluid, solid cooking fuel (eg, Sterno® cans), perfumes, and gas line antifreeze. Ethylene glycol is found in the antifreeze used in car radiators.

Three surveys periodically track substance use by adolescents: the annual *Monitoring the Future Study* of students in grades 8, 9, and 12; the biannual *Youth Risk Behavior Survey* of students in grades 9 through 12; and the annual *National Survey on Drug Use and Health,* which surveys home residents 12 years of age and older. According to the *Monitoring the Future Study*, although 21 years is the legal drinking age in most states, ethanol is the drug used and abused most often by children and adolescents.

Ethanol consumption declined between the late 1970s and the early 1990s, with additional modest decreases in use from the mid-1990s to the early 2000s. In 2005, 17% of 8th graders and 47% of high school seniors reported using alcohol in the last 30 days. Forty-five percent of 12th graders did not view binge drinking as carrying a risk. Adolescents also viewed alcohol as being available, with 64.2% of 8th graders and 93% of 12th graders reporting that it was "fairly easy" or "very easy" to obtain.

Alcohol is involved in more than one third of unintentional injuries, homicides, and suicides, which account for most deaths in the 15- to 19-year age group. The use of alcohol also is associated with other risk-taking behaviors, such as unsafe or increased sexual activity, as well as with sexual victimization. Other negative consequences of alcohol use are impaired relationships with family and peers, problems with school performance, and the potential for addiction.

A family history of alcoholism is one of several predictors of adolescent alcohol use and abuse; children of alcoholics are at increased risk for alcoholism. Studies of twins suggest a genetic predisposition to alcoholism, with chromosomes 9, 15, and 16 likely involved. Alcohols are metabolized by hepatic alcohol dehydrogenase, and polymorphisms in the genes for this enzyme may be markers for a risk of alcoholism. In susceptible adolescents, the time from first use of alcohol to dependence is shorter than in adults.

Peer pressure is another active factor, with 30% of children in the 4th to 6th grades already reporting having received pressure from their peers to drink beer. Alcohol advertising is widely present in the media and is a significant factor influencing adolescents' alcohol use. The home is the most common source of alcohol for adolescents. Protective factors against alcohol use include peer role models, good family communication, and aspirations for the future.

Alcohol intoxication may result from oral intake, either intentional or accidental, or, particularly in infants, by absorption through the skin. Readily diffusing across lipid membranes, alcohol has multiple organ effects.

The signs of ethanol intoxication vary between young children and adolescents. In adolescents, blood concentrations of 80 to 150 mg/dL cause mild neurologic findings, which vary by individual and can include talkativeness, emotional lability, and antisocial behavior. Nausea and vomiting also may occur. As the degree of intoxication increases, additional impairment of neuronal activity may result in more aggression, dysarthria, confusion, ataxia, and lethargy. Severe intoxication results in respiratory depression and coma. Ethanol intoxication may mask toxicities from other drugs. The lethal ethanol concentration in adolescents is 500 mg/dL.

In contrast, intoxicated infants and toddlers are at greater risk for the triad of coma, hypothermia, and hypoglycemia that may be accompanied by metabolic acidosis. These symptoms appear with ethanol levels exceeding 50 to 100 mg/dL. Ethanol-induced seizures may occur, some associated with hypoglycemia. Initial management of ethanol intoxication in children includes maintenance of an airway and measurement of blood glucose. Hypoglycemia should be corrected. Warming may be necessary to correct hypothermia. Because ethanol is absorbed rapidly, there rarely is a role for gastrointestinal decontamination more than 1 hour after ingestion. Hemodialysis rarely is required, unless liver function is impaired or a blood alcohol concentration is greater than 450 to 500 mg/dL.

Ingestion of other alcohols results in many of the same clinical manifestations as ethanol. Methanol itself has little toxicity, but the metabolites formaldehyde and formic acid are highly toxic. Methanol ingestion causes central nervous system depression, acidosis with an anion gap, and reversible or irreversible optic changes. Acidosis may result in multiorgan dysfunction, including pancreatitis, seizures, and cardiac dysrhythmias. Treatment of methanol intoxication includes correction of the acidosis with sodium bicarbonate and administration of folate for disposition of formic acid. Alcohol dehydrogenase antagonists, ethanol and 4-methypyrazole (4-MP), can be used to decrease the formation of the toxic metabolites of methanol. 4-MP has not been approved by the United States Food and Drug Administration for use in children, but it has fewer adverse effects than ethanol and is administered more easily. Hemodialysis may be con-

sidered for very high methanol concentrations (>50 mg/dL).

Ethylene glycol ingestion causes severe metabolic acidosis and the formation of calcium oxalate crystals in vital organs, resulting in hypocalcemia and nephrotoxicity. Therapy includes gastric emptying (only within 1 hour of ingestion), correction of the acidosis and hypocalcemia, and administration of thiamine and pyridoxine, which are cofactors in the nontoxic metabolic pathways of ethylene glycol. Antidiuretic hormone inhibition and hemodialysis also may be used.

Isopropanol impairs mental status more than ethanol does. It also may cause hemorrhagic gastritis and, at high concentrations, myocardial depression. Treatment is supportive unless there is hemodynamic instability, in which case hemodialysis should be used.

Most adolescents who drink do not develop the degree of dependence that results in withdrawal. When withdrawal does occur, symptoms typically develop 6 to 24 hours after the reduction of ethanol intake and last from 2 to 7 days. Alcohol withdrawal symptoms range from mild (insomnia and irritability) to major (diaphoresis, fever, disorientation, and hallucinations). Benzodiazepines are the mainstay of withdrawal treatment.

Treatment for alcohol abuse in adolescents should have the goals of: eliminating alcohol use, or at least moving the adolescent along a continuum to decreasing alcohol use; eliminating other substance use; improving other mental disorders; and restoring family relationships and psychosocial functioning. Effective treatment involves all the social systems in which the adolescent functions, such as family, peers, school, and community. A team approach is best because no one individual can provide all the necessary services. Studies of pharmacologic interventions such as the use of disulfiram in adolescents have been limited. However, for adolescents who have depression and an alcohol use disorder, pilot studies with fluoxetine and sertraline show decreases in depression and alcohol consumption.

Behavioral therapy (once weekly for 1 year) has been found to be more effective than supportive therapy in decreasing substance use, improving school performance, and improving depression; cognitive-behavioral therapy also has been found to be effective. Family-based therapies are the interventions for adolescent substance abuse problems most well studied. These therapies have been found to reduce drug use, address school problems and family dysfunction, and deal with peer relations, all of which can initiate and sustain drug use. Twelve-step programs have been revised for adolescents and have been shown to reduce substance use relapse rates. Any successful intervention must target risk reduction and involve a team approach. Parental involvement is critical.

The relapse rate for adolescents within the first 3 months after treatment is 50% to 70%. Risk factors for relapse are: continued involvement with peers who use, the presence of comorbid conditions, the belief that mild use can be controlled, and continued exposure to situations involving drugs and alcohol.

Prevention of adolescent alcohol abuse by pediatricians requires screening and education. Routine laboratory and physical examination findings are unlikely to reveal alcohol abuse in adolescents. Several screening tools have been validated in adolescents. The CAGE questions are less reliable in adolescents than in adults. The CRAFFT, which is more sensitive than specific, is a six-question tool that is more developmentally appropriate for adolescents. Another tool, the RUFT-Cut, is composed of items taken from several screening tools. It appears to be sensitive and specific, but requires more validation. Particularly because alcohol is strongly associated with injury in adolescents, screening for alcohol use should be part of routine adolescent health care.

Comment: One in six 8th graders has had a drink within the last month, nearly 50% have used alcohol at some time in their lives, and 50% of those have been drunk at least once. This occurs not all that long before they begin driving. How much money, I wonder, does the alcoholic beverage industry spend each year on advertising?

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Editor, In Brief

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