

# **IMPACT OF ALCOHOLISM AND ALCOHOL INDUCED DISEASE AND DISORDERS ON AMERICA**

Alcoholism is a serious disorder that affects the lives of millions of Americans, devastates families, depresses economic vitality, and burdens the country's health care systems. This disease touches virtually all Americans. In 2012, 17 million adults ages 18 years and older had an alcohol use disorder (AUD)<sup>1</sup> a medical condition that physicians diagnose when a person's drinking causes distress or harm.<sup>2</sup> In that same year, approximately 855,000 adolescents (ages 12-17) had an alcohol use disorder.<sup>3</sup> More than half of all adults have a family history of alcoholism or problem drinking. One in four adults 18 years of age and over have, at some point in their lives, used alcohol in ways that adversely impacted their families, communities, and society as a whole.

The untreated misuse of alcohol costs America approximately \$223.5 billion each year. Costs related to medical consequences and alcohol treatment account for eleven percent of this amount; more than 72 percent is attributable to reduced, lost, and forgone earnings; and the remainder is due to lost workforce productivity, accidents, violence, and premature death.<sup>4</sup>

This paper documents the deleterious impact of excessive alcohol use (i.e., heavy drinking, alcohol abuse, and alcoholism) on the United States. Heavy drinking is defined by the National Institute of Alcohol Abuse and Alcoholism (NIAAA) as having four or more drinks in a single day at least once a week for males, and 3 or more drinks for females. Heavy drinking contributes to illness in each of the top three causes of death: heart disease, cancer, and stroke. The Centers for Disease Control and Prevention (CDC) ranks alcohol as the third leading cause of preventable death in the U.S.<sup>5</sup>-- 62,000 men and 26,000 women die from alcohol related causes each year.<sup>6</sup> According to the NIAAA, one in four U.S. adults engage in risky drinking patterns and thus would benefit from counseling or a referral for further evaluation.<sup>7</sup>

The CDC also links excessive alcohol use to numerous immediate and long-term health and safety risks that pose a menace not only to those consuming alcohol but also to those around them. These consequences include traffic fatalities, unintentional firearm injuries, domestic violence and child maltreatment, risky sexual behavior, sexual assault, miscarriage and stillbirth, and a combination of physical and mental birth defects that last a lifetime.

## **Hypertension, Heart Disease and Alcohol Use**

People who drink alcohol excessively have a 1.5 to 2 times increased frequency of high blood pressure. The association between alcohol and high blood pressure is particularly evident when alcohol intake exceeds 5 drinks a day and the prevalence of hypertension is doubled at 6 or more drinks per day. Among potentially modifiable risk factors, alcohol is second only to obesity in its contribution to the frequency of hypertension in men. These findings have yet to be verified in women.<sup>8</sup> Importantly, medical counseling that encourages a reduction in drinking among hypertensive patients can be associated with a reduction in hypertension.

Several studies suggest that moderate alcohol consumption (no more than 2 drinks/day for men and 1 drink/day for women) helps protect against heart disease by raising high density lipoprotein (HDL, or “good”) cholesterol and reducing plaque accumulations in the arteries. Alcohol also has a mild anti-coagulating effect, keeping platelets from coagulating and forming clots. Both actions can reduce the risk of heart attack, although exactly how alcohol influences either process currently is unclear. On the other hand, repeated consumption of more than three drinks a day has a direct toxic effect on the heart. Heavy drinking, particularly over time, can damage the heart and lead to alcoholic cardiomyopathy, congestive heart failure, and hemorrhagic stroke. Heavy drinking also impairs fat metabolism and raises triglyceride levels.

## **Cancer and Alcohol Use**

According to the NIAAA, there is a connection between heavy alcohol consumption and increased risk for cancer, with an estimated 2percent to 4percent of all cancer cases believed to be linked either directly or indirectly to alcohol.<sup>9</sup> A strong association exists between alcohol use and cancers of the esophagus, pharynx, and mouth<sup>10</sup>, whereas a more controversial association links alcohol with breast cancer. Together, these cancers are predicted to kill an estimated 60,490 people in the U.S. in 2014.<sup>11</sup>

## **Alcohol’s Effects on Other Organ Systems**

Alcohol misuse negatively impacts physical/organ systems beyond the heart and vasculature, affecting virtually every organ system. For example, the link between severe liver

dysfunction (i.e., cirrhosis) and excessive alcohol use has been long-recognized. Less appreciated is the fact that nearly all heavy alcohol users develop fatty liver (steatosis)<sup>12</sup>; a condition that is reversible if treated, but may lead to more significant disease if drinking patterns are not moderated. Even if clinical disease is not observed, acute alcohol misuse can negatively affect liver function, compromising the ability of the liver to properly metabolize nutrients<sup>13</sup> and medications<sup>14</sup> which in turn diminishes the effectiveness of a host of medicines such as antibiotics and pain relievers. Heavy drinking inhibits the function of the stomach and the pancreas. Alcohol misuse adversely affects the body's ability to protect itself from acute and chronic disorders and infectious diseases through its dysregulation of the immune system<sup>15</sup>. Bone integrity and remodeling are negatively impacted by alcohol misuse<sup>16</sup>; an issue of particular import for developing adolescents as well as middle-aged and older adults who need to maximize bone support. Despite these recognized associations between alcoholism and organ system integrity, the mechanisms underlying these effects are not completely understood.

## **Alcohol's Effects on Prenatal Development**

Recent data from the Substance Abuse and Mental Health Services Administration (SAMSHA) indicate that nearly 18 percent of pregnant women drink alcohol during their first trimester with 6.6 percent reporting binge drinking (defined as more than 5 drinks on any one occasion). This rate declines during the 2<sup>nd</sup> and 3<sup>rd</sup> trimesters yet recent analyses indicate that the prevalence of Fetal Alcohol Syndrome (FAS) is 2 to 7 cases per 1000 babies born and the frequency of Fetal Alcohol Syndrome Disorders (FASD) is between 20 and 50 cases per 1000.<sup>17</sup> Alcohol's effects on the developing brain in individuals with FASD are life-long and negatively affect multiple skills and behaviors including motor and sensory function, social behaviors, and learning abilities. As individuals with FASD enter adolescence and adulthood, they are at greater risk for a variety of secondary disabilities including psychiatric problems, illicit drug use, delinquent or criminal behavior, precocious or risky sexual activity, and academic failure. Early and continued interventions throughout life can significantly reduce some of these secondary disabilities. There is no known stage of pregnancy or quantity of alcohol consumption that is safe during pregnancy.<sup>18</sup> Current research includes not only prevention but also determining the best early life interventions, establishing and implementing more effective diagnostic tools including biomarkers and genetic factors, and understanding the mechanisms underlying the outcomes associated with FASD.

## **Alcohol's Effects on Brain Function**

Excessive alcohol consumption has a devastating effect on the brain through direct and indirect mechanisms. It can compromise normal brain activity and directly damage cells while impairing the ability of the brain to repair or replace them. Sophisticated brain imaging technologies and neurological testing have shown that misuse of alcohol alters the function of brain areas that are involved in abstract thought, judgment, planning, memory, emotional control, response to stress, and motor coordination. Indirectly, alcohol negatively affects brain function through head injuries suffered in accidents and violent behavior.

Specific groups of people may be more vulnerable to alcohol-associated brain damage than others. On-going research indicates that adolescents, the elderly, and women are particularly susceptible to the neurobehavioral consequences of excessive alcohol use. Mid-life may be a time of increased risk because consumption of five or more drinks on an occasion, at least once a month during that period, increases the chance of developing dementia by three-fold. Adolescents who begin to drink alcohol regularly to intoxication have a four-fold increased likelihood of having an alcohol use disorder in adulthood, compared to individuals who do not begin drinking until age 21. Because the brain continues to develop during this early stage of adolescence, excessive alcohol use at this time increases the risk for brain damage and altered brain function. Some data suggest that excessive alcohol use leads to brain alterations at an earlier stage in women than in men but this proposition requires further study.

## **Alcohol Use and Trauma**

Alcohol often plays a significant role in trauma by increasing both the likelihood and severity of injury. Heavy drinkers or alcohol abusers are more likely than others to be involved in a trauma event.<sup>19</sup> Given similar circumstances, a heavy drinker is also likely to be hurt more seriously than a non-drinker. Moreover, an estimated 27 percent of all trauma patients treated in emergency departments and hospitals are candidates for a brief alcohol intervention.<sup>20</sup>

As noted above, alcohol exposure can alter inflammatory responses and immune function, which may be exacerbated if there is an existing or concurrent injury. The negative impact may be particularly relevant for women. Research suggests that chronic heavy drinking

depresses estrogen levels, nullifying estrogen's beneficial effects on the immune system and weakening a woman's ability to fight infections and tumors. Additionally, some research suggests that this detrimental effect may be compounded by an alcohol-induced elevation in steroidal hormones, known as glucocorticoids, which suppress immune responses in both men and women.<sup>21</sup>

## **Alcohol Use and Automobile and Recreational Incidents**

In 2012, 10,322 people were killed in alcohol-impaired driving crashes, representing 31 percent of all motor vehicle traffic fatalities in the U.S. (an average of one alcohol-impaired-driving fatality every 51 minutes)<sup>22</sup>. Drivers are considered to be alcohol-impaired when their blood alcohol concentration (BAC) is .08 grams per deciliter (g/dL) or higher, although many accidents occur at lower levels. 1.28 million drivers were arrested for driving under the influence of alcohol or narcotics in 2012.<sup>23</sup> This represents less than one percent of the 159 million self-reported episodes of alcohol-impaired driving in the U.S. each year. Of the 1,168 children age 14 and younger killed in motor vehicle crashes in the U.S. in 2012, 239 (20 percent) occurred in alcohol-impaired driving incidents. Children riding in vehicles with drivers who had a BAC of .08 or higher accounted for over half (124) of these deaths.<sup>24</sup>

Alcohol use also plays a role in up to 70 percent of deaths associated with water recreation, almost one-quarter of emergency room visits for drowning, and about one in five reported boating deaths.<sup>25 26 27</sup>

## **Underage Drinking**

The NIAAA, the National Institute on Drug Abuse (NIDA), and the Substance Abuse and Mental Health Services Administration (SAMHSA), have conducted research that demonstrates that substance abuse is particularly problematic in younger adolescents because it is the time when individuals are most likely to begin experimenting with alcohol and other substances and therefore are at increased risk for developing problems with alcohol and other substances. According to the CDC, individuals ages 12 to 20 years drink almost 16 percent of all alcohol consumed in the U.S., and 15 percent of those in this age category (approximately 5.9 million youths) reported binge drinking. (NIAAA defines binge drinking as a pattern of drinking that

brings blood alcohol concentration levels to 0.08 g/dL which usually occurs after 4 drinks for women and 5 drinks for men in about 2 hours' time.)

The 2011 Youth Risk Behavior Survey found that among high school students surveyed, 8.2percent reported driving after drinking alcohol one or more times during the 30 days before the survey. Another 24.1percent indicated that they rode with a driver who had been drinking one or more times during the past 30 days.<sup>28</sup> Due to their inexperience with driving, many teens are involved in accidents at lower blood alcohol levels than the legal limit.

According to SAMHSA, there were approximately 200,000 emergency room visits in 2011 by people under the age of 21 for injuries and other conditions linked to alcohol. This is compared to an estimated 186,000 annual emergency room visits linked to non-alcohol illicit substances by persons under 21.<sup>29</sup>

## **Alcohol Use and College Students**

Alcohol use by college students is alarmingly pervasive and exceptionally harmful. Data from 2012 show that 60.3 percent of college students (ages 18 to 22) drank alcohol in the past month<sup>30</sup> and 40.1 percent of them engaged in binge drinking.<sup>31</sup> Heavy drinking – 5 or more drinks on 5 or more occasions per month – was engaged in by 14.4 percent of college students.<sup>32</sup>

The consequences of such excessive alcohol use are serious: 1,825 college students die from alcohol-related motor vehicle crashes and unintentional injuries;<sup>33</sup> 97,000 students said that they had been subject to date rape or alcohol-related sexual assault;<sup>34</sup> and nearly 700,000 students reported being assaulted by a fellow student who had consumed alcohol.<sup>35</sup> Nearly one-quarter of college students stated that they have suffered adverse academic consequences from alcohol consumption ranging from missing classes to achieving lower grades.<sup>36</sup>

## **Alcohol Use Among Active Military and Veterans**

In 2012, the Institute of Medicine found that alcohol and drug use in the armed forces is “unacceptably high”, constitutes a “public health crisis”, and is “detrimental to force readiness

and psychological fitness.”<sup>37</sup> The Department of Defense’s 2011 Health Related Behaviors Survey of Active Duty Military Personnel revealed that across all military services, 9.9 percent of personnel were classified as abstainers, 5.7 percent were former drinkers, 58.6 percent were infrequent/light drinkers (fewer than 4 drinks/week on average in past 12 months), 17.5 percent were moderate drinkers (4 to 14 drinks/week on average for males; 4 to 7 drinks/week on average for females), and 8.4 percent were heavy drinkers (more than 14 drinks/week on average for males, more than 7 drinks/week on average for females).<sup>38</sup>

The DOD survey determined that “among current drinkers, 39.6 percent reported binge drinking at least once in the past 30 days, defined as having 5 or more drinks for males and 4 or more drinks for females on the same occasion, and 27.8 percent reported feeling drunk 7 or more times in the past year.”<sup>39</sup> According to the DOD report, a larger percentage of service members were heavy and binge drinkers (8.8 percent) compared to the civilian population (5.1 percent) although the overall younger age of military personnel may explain some of the difference.<sup>40</sup>

The DOD also concluded that 58.4 percent of all heavy drinkers were at risk for alcohol problems and nearly one-third of them (32.4 percent) reported experiencing one or more work-related productivity loss indicators, 30.0 percent reported experiencing one or more serious consequences from drinking, and 32.2 percent replied that they had engaged in one or more risk behaviors.<sup>41</sup>

It has been estimated that problematic alcohol use in the U.S. military has caused significant financial and productivity losses. By one estimate, excessive alcohol consumption costs the U.S. government \$1.12 billion annually. Medical expenditures associated with alcohol misuse are approximately \$425 million per year. Furthermore, excessive drinking by service members causes the loss each year of an estimated 320,000 workdays and results in 34,400 arrests half of which are for driving under the influence.<sup>42</sup>

Patterns of alcohol abuse, which may be acquired in the military, frequently persist after discharge from service and are associated with a high-rate of alcohol-related health disorders in the veteran population. A study of 88,235 veterans who had returned from Operation Iraqi Freedom, found that 12 to 15 percent reported misuse of alcohol in the 3 to 6 months after their

return from combat. According to this analysis, the data suggest that excessive alcohol use occurs among veterans who had experienced combat traumatic stress.<sup>43</sup>

## **Alcohol Misuse and the Family**

About one-third of Americans have a family member with a current or past alcohol problem and 10.5 percent of minor children live in a family with a parent with an alcohol use disorder. Alcohol misuse within the family is often associated with financial, emotional, geographic, and marital instability. Such instability, in turn, has been shown to negatively impact parent-child bonding, challenge achievement of developmental milestones, limit academic advancement, and constrain social development. These limitations affect decision-making and can impact career and interpersonal choices into adulthood. For these reasons, alcohol misuse within the family affects not only the immediate family cohort, but also the next generation. Genetic and environmental factors may contribute to these problems as well.

Families that have a heavy drinking member typically have more medical and psychiatric diagnoses and higher health care costs than families with a family member with other chronic conditions such as diabetes or asthma (or than families in general).<sup>44</sup> However, if the individual with the alcohol use disorder becomes abstinent, health care costs for the family decrease over time to the same level as other families. Alcohol use disorders are costly to families in time and money.<sup>45</sup> Treatment makes a difference in terms of family expenditures, with at least one study finding that family expenditures and time required to provide care and assistance related to the alcohol use disorder were reduced by 75 percent, on average, after treatment.<sup>46</sup>

## **Domestic Violence, Crimes, and Alcohol Use**

The relationship between alcohol misuse (or other substance abuse) and domestic violence is complicated. Frequently, the perpetrator, the victim, or both have been using alcohol heavily. In the U.S., numerous studies have demonstrated that excessive alcohol use is predictive of intimate partner violence and contributes to the severity of the violence.<sup>47</sup> It also is clear that excessive alcohol use can increase intimate partner violence to a greater extent in individuals with a predisposition for physical aggression. Effectively treating alcohol use problems has been correlated with significant reductions in intimate partner violence. Alcohol is

also associated with other types of violence. For example, for the period from 2004-2008, it was estimated that 46 percent of stranger victimizations were reported to have involved alcohol.<sup>48</sup>

## **The Cost of Alcohol Use to Business and The Economy**

Employee alcohol use reduces productivity, impairs job performance, increases health care costs, and can threaten public safety. Based on 2006 data, it has been estimated that excessive use of alcohol costs the U.S. \$223 billion do to business productivity losses, health care expenses, law enforcement and criminal justice costs, and motor vehicle accidents.<sup>49</sup> The federal government estimates that 8.9 percent of full-time workers (12.7 million people) have drinking problems. People with alcohol use disorders utilize twice as much sick leave as other employees, are five times more likely to file workmen's compensation claims, and are more likely to cause injuries to themselves or others while on the job.<sup>50 51 52 53 54 55 56</sup>

Treatment substantially reduces drinking among people with alcohol use disorders, and 40percent to 60percent of those treated alcohol and drug problems remain abstinent after a year. Because 85 percent of heavy drinkers work, employers who aggressively address this problem can improve their employees' health while enhancing company performance. By providing comprehensive health benefits that cover treatment for alcohol use disorders, employers can reduce their health care and personnel costs as well as contribute to employees' well-being and productivity.<sup>57</sup>

## **Treatment for Alcohol Use Disorders**

### **Behavioral**

A number of behavioral therapies have been found to be effective in the treatment of alcohol use disorders. Various treatments focus on improving coping skills in stressful situations, increasing readiness to change in individuals not strongly motivated to reduce or stop drinking, or encouraging participation in self/mutual support programs. Several effective behavioral interventions feature a combination of approaches, and may include rewards for abstinence as well as access to community resources and sober social events. Interventions that integrate treatment for alcohol use disorders with care for other medical disorders produce greater improvements in drinking outcomes than the provision of separate services for each

condition. Promising work is being done in the area of electronic monitoring and delivery of behavioral therapies by telephone and through electronic devices using social media.

Individuals with different severities of alcohol use problems require different approaches to treatment. For example, for people with less severe alcohol problems, there is considerable evidence that brief interventions provided in primary care settings can lead to significant reductions in rates of hazardous or risky alcohol use. Conversely, in individuals with more severe alcohol problems, who have little social support for recovery, or experienced a poor initial response to treatment, extended continuing care may be required to achieve sustained recovery. Not all individuals will have a positive response to a behavioral intervention, and modifications to a treatment plan, including pharmacotherapy, may be needed to achieve and sustain a good response.

#### Medication/Pharmacotherapies

There are three medications currently approved by the Food and Drug Administration (FDA) specifically for treating alcohol use disorders: disulfiram, naltrexone (daily oral and long-acting injectable) and acamprosate. Daily oral disulfiram (Antabuse<sup>®</sup> or Antbus<sup>®</sup>), available for about 50 years, inhibits alcohol metabolism in the liver and causes a negative physical reaction if alcohol is consumed. It is considered a “deterrent medication” and has minimal impact on craving, which emanates from the brain. Naltrexone (Depade<sup>®</sup>, Revia<sup>®</sup>, or depot Vivitrol<sup>®</sup>) was approved by the FDA almost 20 years ago and works on the brain by blocking the action of naturally occurring opiates (natural pain-killers) that are released when people drink. This drug may work best in populations with a specific genetic makeup. Acamprosate (Campral<sup>®</sup>), taken as a daily oral tablet, was approved in 2004 and works by stabilizing a brain chemical system that is very sensitive to alcohol. All of these pharmacotherapies are moderately effective at best and accordingly there is continued effort to find additional pharmacotherapeutic agents.

Several other medications approved by the FDA for use with other diseases have been found to be useful in reducing heavy drinking and decreasing the risk for relapse including topiramate (Topamax<sup>®</sup>) and varenicline (Chantrix<sup>®</sup>). Recent pharmacotherapy studies of alcohol use disorders are beginning to focus on “personalized care” (i.e. personalized medicine), examining the effectiveness of each medication in relation to individual genetic differences. This research provides additional hope for treatment. An estimated 20 million Americans could

benefit from the medications mentioned above, but only about 500,000 - 1 million individuals actually receive them.

Outcomes are improved for individuals who receive treatment – whether behavioral or pharmacological.<sup>58 59 60 61</sup> For this reason, there is a continuing need to identify more effective ways to engage alcoholics in the treatment process and to find ways to address not only drinking behaviors, per se, but also other aspects of successful living including social adaptation and cognitive recovery.

## **Genetics and Alcohol Use**

Family, twin, and adoption studies demonstrated many years ago that alcoholism is a complex disease with some genetic influence (i.e., a heritable component). This means that some genes that are inherited affect the risk for the disease, but they do not alone lead to alcoholism. Furthermore, alcoholism is not a single gene disorder; multiple genes as well as environmental and other factors play important roles. Although the majority will not develop an alcohol use disorder, children of alcoholics have a 2- to 6-fold higher risk for the disease. Environmental factors, including social factors that increase stress, can increase an individual's vulnerability. There are also protective environments that can decrease risk. Individual differences in risk are partly related to sensitivity to the effects of alcohol which is influenced by genetic factors. Individuals who are less sensitive to alcohol may drink more to enhance the effect. Some of the genetic predisposition to alcohol problems also appears to be through general problem behavior pathways such as those leading to increased aggression or impulsivity. There is also evidence that some of the same genetic factors can influence risk for alcoholism, anxiety, and depression. Accordingly, certain individuals with an increased risk for alcohol-related problems may also be prone to depression and anxiety. Additional research is needed in this area.

Two genes that control the metabolism of alcohol are known to impact risk for an alcohol use disorder but most of the genes that affect risk have yet to be identified. Research is ongoing to identify additional genes, including rare variants that might produce more pronounced effects. Genetic factors also contribute to a person's vulnerability to many of the harmful consequences of excessive alcohol consumption, including cancer, heart disease, and liver disease. Identifying specific genetic contributions to the risks and how they interact with the

environment has the potential to help develop more effective prevention programs, stimulate discovery of new treatments, and better match treatments to each patient.

## **Conclusion**

While the high rate of alcohol misuse is a devastating problem of national importance, the good news is that this nation is poised to capitalize on unprecedented opportunities in alcohol research, treatment, and prevention. These opportunities must be seized. Scientists are exploring new and exciting ways to prevent alcohol-associated accidents and violence and prevention trials are developing methods to address problem alcohol use. Continued efforts to identify the psychosocial factors which affect both risk and resiliency will lead to further improvements in prevention and early intervention. Medication development is proceeding faster than any time in the past 50 years, with many new compounds being developed and tested. Furthermore, researchers have identified regions of the human genome that contribute to inherited risk of alcohol use disorders. Innovative genetic research will accelerate the rational design of medications to treat alcohol use disorders and improve the understanding of the interaction of heredity and environment in the etiology of alcohol use disorders and alcohol-related problems.

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