

willow tree

Psychiatry llc



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As a country, we have a serious substance misuse problem — use of alcohol, illegal drugs, and/or prescribed medications in ways that produce harms to ourselves and those around us. These harms are significant financially with total costs of more than \$420 billion annually and more than \$120 billion in healthcare (1,2). But these problems are not simply financial burdens — they deteriorate the quality of our health, educational, and social systems, and they are debilitating and killing us — particularly our young through alcohol-related car crashes, drug related violence, and medication overdoses.

Most Americans are already painfully aware of the size and cost of substance misuse problems. Many Americans believe that there are no viable solutions to what they think of as these unfortunate “lifestyle problems” — that they are as intractable as poverty and ignorance. However, a review of the available science offers a much more optimistic projection for our efforts to reduce these problems. As will be discussed, substance misuse can reasonably be considered a lifestyle problem, but there are effective prevention policies and practices that could significantly reduce the harms and costs of these problems. Genetic, brain imaging, and neurobiological science suggests that “addiction” is qualitatively different from substance use and is now best understood as an acquired chronic illness, similar in many respects to type 2 diabetes — illnesses that can be managed but not yet cured.

In this regard, science has already produced a range of effective interventions, treatment medications, behavioral therapies, and recovery support services that make full recovery from even serious addictions an expectable result of professional, continuing, evidenced-based care. Also, recent changes in healthcare insurance regulation and financing now open the door to integration of prevention and treatment of substance use disorders into mainstream medicine in ways that were previously not possible.

Thus, the first and perhaps most important message from this paper is NOT that that substance misuse and disorders cause immensely expensive and socially devastating harms and costs. Rather, the major message from this paper is that science now offers a public health-oriented approach to translate the available science into effective, practical, and sustainable policies and practices to prevent substance “use” before it starts; identify and intervene early with emerging cases of substance “misuse”; and effectively treat serious substance use disorders.

In this paper a “substance” is defined as any psychoactive compound with the potential to cause health and social problems, including addiction. These substances may be legal (e.g., alcohol and tobacco); illegal (e.g., heroin and cocaine); or controlled for use by licensed prescribers for medical purposes such as hydrocodone or oxycodone (e.g., Oxycontin, Vicodin, and Lortab). These substances can be arrayed into seven classes based on their pharmacological and behavioral effects:

- Nicotine — cigarettes, vapor-cigarettes, cigars, chewing tobacco, and snuff
- Alcohol — including all forms of beer, wine, and distilled liquors
- Cannabinoids — Marijuana, hashish, hash oil, and edible cannabinoids
- Opioids — Heroin, methadone, buprenorphine, Oxycodone, Vicodin, and Lortab
- Depressants — Benzodiazepines (e.g., Valium, Librium, and Xanax) and Barbiturates (e.g., Seconal)
- Stimulants — Cocaine, amphetamine, methamphetamine, methylphenidate (e.g., Ritalin), and atomoxetine (e.g., Stratera)
- Hallucinogens — LSD, mescaline, and MDMA (e.g., Ecstasy)

Although different in many respects, all substances discussed here share three features that make them important to public health and safety. First, all are widely used and misused: 61 million people in the United States admitted to binge drinking in the past year and more than 44 million people used an illicit or non-prescribed drug in the past year (3). Second, using any of these substances at high doses or in inappropriate situations can cause a health or social problem — immediately or over time. This is called substance misuse. One important and very prevalent type of substance misuse is binge drinking. Binge drinking for men is drinking 5 or more standard alcoholic drinks in one sitting (a few hours). For women, it is drinking 4 or more standard alcoholic drinks in one sitting (4). The health and social problems from misuse of alcohol or any of the other above substances can be as simple as low severity and transient embarrassment. But misuse can also result in serious, enduring, and costly consequences, such as an arrest for driving under the influence (DUI), an automobile crash, intimate partner and sexual violence, child abuse and neglect, suicide attempts and fatalities, a stroke, or an overdose death.

The third feature shared by all of the above substances is that prolonged, repeated use of any of these substances at high doses and/or high frequencies (quantity/frequency thresholds vary across substances) can produce not only the kinds of problems described above, but a separate, independent, diagnosable illness that significantly impairs health and function and may require special treatment. This illness is called a substance use disorder. Disorders can range from mild

and temporary to severe and chronic. Severe and chronic substance use disorders are commonly called addictions (diagnosis discussed below).

To understand the scope, severity, and societal costs of substance use in the United States, it is first necessary to understand just how many people use these substances and at what level of severity. Table 1 provides selected findings from the 2015 *National Survey on Drug Use and Health (NSDUH)* (4) on a sample of 265 million individuals 12 years of age and older.

TABLE 1

2015 Prevalence of Use, New Initiation, and Severe Disorders by Substance

Type of Drug	Used in Past Year, n (%)	Initiated in Past Year, n (%)	Substance Disorder ^a in Past Year, n (%)
Heavy alcohol drinking ^b	16.3 (23.0)	4.7 (1.8)	17.0 (6.4)
Marijuana	35.0 (13.2)	2.6 (1.0)	4.2 (1.6)
Opioids (heroin and prescription drugs)	11.2 (4.2)	1.6 (0.6)	2.5 (1.1)
Sedatives/tranquilizers	6.0 (2.3)	1.3 (0.5)	0.6 (0.3)
Stimulants including methamphetamine	3.7 (1.4)	0.7 (0.3)	0.5 (0.2)
Hallucinogens	4.3 (1.6)	0.9 (0.3)	0.2 (0.1)
Cocaine	4.6 (1.7)	0.9 (0.3)	0.9 (0.3)
Any of the above except alcohol	44.0 (17.0)	7.8 (2.9)	21.4 (8.1)

In Table 1, approximately 17% of the 12 years of age or older population (44 million people) reported use of an illegal drug, non-medical use of a prescribed drug, or heavy alcohol use during the prior year. Almost 3% (7.8 million) initiated some form of substance use in the prior year; and 8% (21.4 million) met diagnostic criteria for a substance use disorder.

Several specific findings shown in Table 1 bear emphasis. For example, more than 34 million people reported “heavy drinking” in the past year [binge drinking 5 or more times (4)]. As indicated, this level of alcohol use is associated with many health and social problems. Marijuana was the most frequently used drug (35 million past year users) and use has increased significantly over the past 5 years, likely as a result of the many state laws that have approved its use for medical purposes or even non-medical use. Medical marijuana is now legal in 28 states, and 8 states have voted to legalize recreational marijuana.

Non-medical use of prescription drugs was reported by almost 15 million individuals in the national survey (5.5% of the population). Within this category, prescribed brand-name opioid pain

relievers (e.g., Oxycontin, Vicodin, and Lortab,) accounted for 69% of the prevalence (10 million people) followed by sedatives/tranquilizers (e.g., Valium and Xanax) or stimulants (e.g., Adderall or Ritalin), each reported by 4 million people.

Significance of Substance Misuse

It may be thought that a discussion of substance use and misuse is secondary to the real issue of addiction that has captured so many media headlines and has been linked to so many social problems. This is an important misconception: the great majority of substance-related health and social problems occur among those who are not addicted. Individuals with severe substance use disorders (addictions) do have high rates of substance misuse-related health and social problems and costs; but as shown in [Table 1](#), these individuals are a rather small proportion of the misusing population.

Perhaps the best example of this is binge drinking, which was self-reported by 61 million individuals in 2015. By definition, each misuse episode carries the potential for immediate harm to the user and/or to those around them (e.g., car accident, violence, or alcohol poisoning). However, only 17 million individuals — approximately 28% of all binge drinkers — met diagnostic criteria for an alcohol use disorder. Similarly, approximately 2.5 million people met diagnostic criteria for an opioid use disorder, but more than 11 million individuals misused heroin or a prescribed opioid medication in the past year — setting the occasion for a potential overdose.

One particularly clear implication from these findings is that reducing the harms and costs of substance related problems in the United States cannot occur simply by treating addictions. The greatest public health benefit will come from reducing substance misuse in the general population. Of course, reducing population rates of substance misuse will also reduce rates of addiction (see below).

Harms and Costs Associated With Substance Misuse

The Centers for Disease Control and Prevention (CDC) estimate binge drinking costs the United States approximately \$249 billion each year (5) in lost workplace productivity, health care expenses for medical problems associated with binge drinking, law enforcement costs, and costs of motor vehicle crashes. Similarly, the National Drug Intelligence Center found that misuse of illegal drugs and non-prescribed medications cost the United States more than \$193 billion per year (2). Again, these costs were due primarily to lost productivity by working substance misusers (62%) and criminal justice costs for drug-related crimes (32%).

Medical costs associated with undiagnosed, untreated substance misuse and substance use disorders have been estimated at more than \$120 billion annually. The general population prevalence of substance use disorders is 8% to 10% (6% to 7% for women, 9% to 11% for men), but the prevalence is far higher in all areas of medical care — from approximately 20% in typical

primary care clinics, to 40% in general medical patients treated in hospital, to more than 70% of patients in emergency or urgent care clinics. A recent study showed that the presence of an early substance use disorder often doubles the odds for the subsequent development of chronic and expensive medical illnesses such as arthritis, chronic pain, heart disease, stroke, hypertension, diabetes, and asthma (6). In general medical practice, failure to detect and address substance use has been associated with misdiagnoses (7), poor adherence to prescribed care (8), high use of hospital and emergency services (9), and even deaths.

Despite the extraordinary costs, morbidity, and mortality associated with substance misuse it has been broadly overlooked throughout all of healthcare. This has been a costly mistake, with often deadly consequences.

Poisoning, or overdose, deaths are typically caused by binge drinking at high intensity and/or by consuming combinations of substances such as alcohol, sedatives, tranquilizers, and opioid pain relievers to the point where there is inhibition of critical brain areas that control breathing, heart rate, and body temperature.

Alcohol Overdose

The CDC reported more than 2,200 alcohol poisoning deaths in 2014 — an average of six deaths every day (10). Importantly, approximately 70% of those alcohol-overdose deaths occurred among those who did not meet diagnostic criteria for alcohol dependence; nor were they using other drugs at the time of the death (10).

Opioid Overdose (Heroin and Prescribed Opioids)

Opioid analgesic pain relievers are now the most prescribed class of medications in the United States with more than 289 million prescriptions written each year (11,12). The increase in prescriptions of these powerful analgesics has been accompanied by a 300% increase since 2000 in both rates of overdose incidents (478,000) and overdose deaths (18,893 involving prescription opioids and 10,500 involving heroin) in 2014 (13,14).

To address this problem, researchers, medical societies, and the CDC have suggested “...(1) screening patients for use...of alcohol and/or street drugs; (2) taking extra precautions when prescribing medicines with known dangerous interactions with alcohol and/or street drugs; and (3) teaching the patient the risks of mixing medicines with alcohol and/or street drugs” (15). Again, screening for substance use and substance use disorders before and during the course of opioid prescribing, combined with patient education, are recommended (15).

Again, despite these and other indications of extreme threats to healthcare quality, safety, effectiveness, and cost containment, as of this writing, few general healthcare organizations screen for, or offer services for, the early identification and treatment of substance use disorders.

Moreover, few medical, nursing, dental, or pharmacy schools teach their students about substance use disorders.

As is the case with most other chronic illnesses, 40% to 70% of a person's risk for developing a substance use disorder is genetic (16), but many environmental factors interact with a person's genes to modify their risk, such as being raised in a home in which the parents or other relatives use alcohol or drugs (17,18) or living in neighborhoods and going to schools with high prevalence of alcohol and drug misuse are also risk factors (17,19, 20).

Risk and Protective Factors: Keys to Vulnerability

Neither substance misuse problems nor substance use disorders are inevitable. An individual's vulnerability can be predicted by assessing the nature and number of their personal and environmental risk and protective factors.

Significant environmental risk factors for both substance misuse and disorders include easy access to inexpensive alcohol and other substances, heavy advertising of these products, particularly to youth, low parental monitoring, and high levels of family conflict (16). Environmental protective factors include availability of healthy recreational and social activities, and regular supportive monitoring by parents (16).

At the personal level, major risk factors include a family history of substance use or mental disorders, a current mental health problem, low involvement in school, a history of abuse and neglect, and family conflict and violence (16). Some important personal protective factors include involvement in school, involvement in healthy recreational/social activities, and development of good coping skills (16).

Prevention science has concluded that there are three important points regarding vulnerability. First, no single personal or environmental factor determines whether an individual will have a substance misuse problem or disorder. Second, most risk and protective factors can be modified through preventive policies and programs to reduce vulnerability. Finally, although substance misuse problems and disorders may occur at any age, adolescence and young adulthood are particularly critical at-risk periods.

With regard to substance use disorders, research now indicates that more than 85% of those who meet criteria for a substance use disorder sometime in their lifetime do so during adolescence (21). Put differently, young adults who transition the adolescent years without meeting criteria for a substance use disorder are not likely to ever develop one (21, 22).

Neurobiological research has identified one likely reason for elevated adolescent vulnerability. Alcohol and other substances have particularly potent effects on undeveloped brain circuits and recent scientific findings indicate that brain development is not complete until approximately 21 to 23 years of age in women and 23 to 25 years of age in men (23–25). Among the last brain region

to reach maturity is the prefrontal cortex, the brain region primarily responsible for “adult” abilities such as delay of reward, extended reasoning, and inhibition. These findings combine to suggest that adolescence is perhaps the most critical period for prevention and early interventions.

Changes in Medical Understanding About the Etiology of Substance Use Disorders

Until the recently, the continued use of substances “despite adverse consequences” was considered substance abuse. In contrast, addiction was the diagnostic term reserved for conditions manifest by physiological tolerance and withdrawal. This suggested that only substances capable of producing tolerance and withdrawal (so-called “hard drugs”) could be addictive and that substances such as marijuana, LSD, and even cocaine were relatively safer.

The current diagnostic criteria (*Diagnostic and Statistical Manual, 5th Edition*) listed in Table 2 include 11, equally weighted symptoms, generally related to “loss of behavioral control” — the cardinal feature of addiction (26). Individuals with fewer than two symptoms are not considered to have a disorder, although they may have had at least one misuse problem. Those exhibiting two to three symptoms are considered to have a “mild” disorder, four to five symptoms constitute a “moderate” disorder, and six or more symptoms is considered a “severe” substance use disorder — commonly called addiction (26). These criterial are likely to reduce the all-or-none thinking (i.e., addicted or not addicted) that has characterized clinical approaches in this field.