

Understanding Drug Abuse and Addiction

Many people do not understand why or how other people become addicted to drugs. It can be wrongfully assumed that drug abusers lack moral principles or willpower and that they could stop using drugs simply by choosing to change their behavior. In reality, drug addiction is a complex disease, and quitting takes more than good intentions. In fact, because drugs change the brain in ways that foster compulsive drug abuse, quitting is difficult, even for those who are ready to do so. Through scientific advances, we know more about how drugs work in the brain than ever, and we also know that drug addiction can be successfully treated to help people stop abusing drugs and lead productive lives.

Drug abuse and addiction have negative consequences for individuals and for society. Estimates of the total overall costs of substance abuse in the United States, including productivity and health- and crime-related costs, exceed \$600 billion annually. This includes approximately \$181 billion for illicit drugs,¹ \$193 billion for tobacco,² and \$235 billion for alcohol.³ As staggering as these numbers are, they do not fully describe the breadth of destructive public health and safety implications of

drug abuse and addiction, such as family disintegration, loss of employment, failure in school, domestic violence, and child abuse.

What Is Drug Addiction?

Addiction is a chronic, often relapsing brain disease that causes compulsive drug seeking and use, despite harmful consequences to the addicted individual and to those around him or her. Although the initial decision to take drugs is voluntary for most people, the brain changes that occur over time challenge a person's self control and ability to resist intense impulses urging them to take drugs.

Fortunately, treatments are available to help people counter addiction's powerful disruptive effects. Research shows that combining addiction treatment medications with behavioral therapy is the best way to ensure success for most patients. Treatment approaches that are tailored to each patient's drug abuse patterns and any co-occurring medical, psychiatric, and social problems can lead to sustained recovery and a life without drug abuse.

Similar to other chronic, relapsing diseases, such as diabetes, asthma, or heart disease, drug addiction can be managed successfully. And as with other chronic diseases, it is not

uncommon for a person to relapse and begin abusing drugs again. Relapse, however, does not signal treatment failure—rather, it indicates that treatment should be reinstated, adjusted, or that an alternative treatment is needed to help the individual regain control and recover.

What Happens to Your Brain When You Take Drugs?

Drugs contain chemicals that tap into the brain's communication system and disrupt the way nerve cells normally send, receive, and process information. There are at least two ways that drugs cause this disruption: (1) by imitating the brain's natural chemical messengers and (2) by overstimulating the "reward circuit" of the brain.

Some drugs (e.g., marijuana and heroin) have a similar structure to chemical messengers called neurotransmitters, which are naturally produced by the brain. This similarity allows the drugs to "fool" the brain's receptors and activate nerve cells to send abnormal messages.

Other drugs, such as cocaine or methamphetamine, can cause the nerve cells to release abnormally large amounts of natural neurotransmitters (mainly dopamine) or to prevent the normal recycling of these brain chemicals, which is needed to shut off the signaling between neurons. The result is a brain awash in dopamine, a neurotransmitter

present in brain regions that control movement, emotion, motivation, and feelings of pleasure. The overstimulation of this reward system, which normally responds to natural behaviors linked to survival (eating, spending time with loved ones, etc.), produces euphoric effects in response to psychoactive drugs. This reaction sets in motion a reinforcing pattern that "teaches" people to repeat the rewarding behavior of abusing drugs.

As a person continues to abuse drugs, the brain adapts to the overwhelming surges in dopamine by producing less dopamine or by reducing the number of dopamine receptors in the reward circuit. The result is a lessening of dopamine's impact on the reward circuit, which reduces the abuser's ability to enjoy the drugs, as well as the events in life that previously brought pleasure. This decrease compels the addicted person to keep abusing drugs in an attempt to bring the dopamine function back to normal, except now larger amounts of the drug are required to achieve the same dopamine high—an effect known as *tolerance*.

Long-term abuse causes changes in other brain chemical systems and circuits as well. Glutamate is a neurotransmitter that influences the reward circuit and the ability to learn. When the optimal concentration of glutamate is altered by drug abuse, the brain attempts to compensate, which can

impair cognitive function. Brain imaging studies of drug-addicted individuals show changes in areas of the brain that are critical to judgment, decisionmaking, learning and memory, and behavior control. Together, these changes can drive an abuser to seek out and take drugs compulsively despite adverse, even devastating consequences—that is the nature of addiction.

Why Do Some People Become Addicted While Others Do Not?

No single factor can predict whether a person will become addicted to drugs. Risk for addiction is influenced by a combination of factors that include individual biology, social environment, and age or stage of development. The more risk factors an individual has, the greater the chance that taking drugs can lead to addiction. For example:

- **Biology.** The genes that people are born with—in combination with environmental influences—account for about half of their addiction vulnerability. Additionally, gender, ethnicity, and the presence of other mental disorders may influence risk for drug abuse and addiction.
- **Environment.** A person's environment includes many different influences, from family and friends to socioeconomic status and quality of life in general. Factors such

as peer pressure, physical and sexual abuse, stress, and quality of parenting can greatly influence the occurrence of drug abuse and the escalation to addiction in a person's life.

- **Development.** Genetic and environmental factors interact with critical developmental stages in a person's life to affect addiction vulnerability. Although taking drugs at any age can lead to addiction, the earlier that drug use begins, the more likely it will progress to more serious abuse, which poses a special challenge to adolescents. Because their brains are still developing in the areas that govern decisionmaking, judgment, and self-control, adolescents may be especially prone to risk-taking behaviors, including trying drugs of abuse.

Prevention Is the Key

Drug addiction is a preventable disease. Results from NIDA-funded research have shown that prevention programs involving families, schools, communities, and the media are effective in reducing drug abuse. Although many events and cultural factors affect drug abuse trends, when youths perceive drug abuse as harmful, they reduce their drug taking. Thus, education and outreach are key in helping youth and the general public understand the risks of drug abuse. Teachers, parents, medical and

public health professionals must keep sending the message that drug addiction can be prevented if one never abuses drugs.

Other Information Sources

For information on understanding drug abuse and addiction, please see our booklet, *Drugs, Brains, and Behavior—The Science of Addiction*, at www.nida.nih.gov/scienceofaddiction.

For more information on prevention, please visit www.nida.nih.gov/drugpages/prevention.html.

For more information on treatment, please visit www.nida.nih.gov/drugpages/treatment.html. To find a publicly funded treatment center in your State, please call 1-800-662-HELP or visit www.findtreatment.samhsa.gov.

References

¹ Office of National Drug Control Policy. *The Economic Costs of Drug Abuse in the United States, 1992–2002*. Washington, DC: Executive Office of the President (Publication No. 207303), 2004.

² Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, U.S. Department of Health and Human Services. *Best Practices for Comprehensive Tobacco Control Programs—2007*. Available at: http://www.cdc.gov/tobacco/stateandcommunity/best_practices/pdfs/2007/bestpractices_complete.pdf.

³ Rehm, J., Mathers, C., Popova, S., Thavorncharoensap, M., Teerawattananon Y., Patra, J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *Lancet*, 373(9682):2223–2233, 2009.



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