

# Drug Facts

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## Anabolic Steroids

“Anabolic steroids” is the familiar name for synthetic variants of the male sex hormone testosterone. The proper term for these compounds is *anabolic-androgenic steroids* (abbreviated AAS)—“anabolic” referring to muscle-building and “androgenic” referring to increased male sexual characteristics.

Anabolic steroids can be legally prescribed to treat conditions resulting from steroid hormone deficiency, such as delayed puberty, as well as diseases that result in loss of lean muscle mass, such as cancer and AIDS. But some athletes, bodybuilders, and others abuse these drugs in an attempt to enhance performance and/or improve their physical appearance.

### How Are Anabolic Steroids Abused?

Anabolic steroids are usually either taken orally or injected into the muscles, although some are applied to the skin as a cream or gel. Doses taken by abusers may be 10 to 100 times higher than doses prescribed to treat medical conditions.

Steroids are typically taken intermittently rather than continuously, both to avert unwanted side effects and to give the body’s hormonal system a periodic chance to recuperate. Continuous use of

steroids can decrease the body’s responsiveness to the drugs (tolerance) as well as cause the body to stop producing its own testosterone; breaks in steroid use are believed to redress these issues. “Cycling” thus refers to a pattern of use in which steroids are taken for periods of weeks or months, after which use is stopped for a period of time and then re-started.

In addition, users often combine several different types of steroids and/or incorporate other steroidal or non-steroidal supplements in an attempt to maximize their effectiveness, a practice referred to as “stacking.”

### How Do Anabolic Steroids Affect the Brain?

Anabolic steroids work very differently from other drugs of abuse, and they do not have the same acute effects on the brain. The most important difference is that steroids do not trigger rapid increases in the neurotransmitter dopamine, which is responsible for the rewarding “high” that drives the abuse of other substances.

However, long-term steroid use can affect some of the same brain pathways and chemicals—including dopamine, serotonin, and opioid systems—that are

affected by other drugs, and thereby may have a significant impact on mood and behavior.

Abuse of anabolic steroids may lead to aggression and other psychiatric problems, for example. Although many users report feeling good about themselves while on steroids, extreme mood swings can also occur, including manic-like symptoms and anger (“roid rage”) that may lead to violence. Researchers have also observed that users may suffer from paranoid jealousy, extreme irritability, delusions, and impaired judgment stemming from feelings of invincibility.

### Are Steroids Addictive?

Even though anabolic steroids do not cause the same high as other drugs, steroids are reinforcing and can lead to addiction. Studies have shown that animals will self-administer steroids when given the opportunity, just as they do with other addictive drugs. People may persist in abusing steroids despite physical problems and negative effects on social relationships, reflecting these drugs’ addictive potential. Also, steroid abusers typically spend large amounts of time and money obtaining the drug—another indication of addiction.

Individuals who abuse steroids can experience withdrawal symptoms when they stop taking them—including mood swings, fatigue, restlessness, loss of appetite, insomnia, reduced sex drive, and steroid cravings, all of which may contribute to continued abuse. One of the most dangerous withdrawal symptoms is depression—when persistent, it can sometimes lead to suicide attempts. Research has found that some steroid abusers turn to other drugs such as opioids to counteract the negative effects of steroids.

### What Are the Other Health Effects of Anabolic Steroids?

Steroid abuse may lead to serious, even irreversible, health problems. Some of the most dangerous consequences that have been linked to steroid abuse include kidney impairment or failure; damage to the liver; and cardiovascular problems including enlargement of the heart, high blood pressure, and changes in blood cholesterol leading to an increased risk of stroke and heart attack (even in young people).

Steroid use commonly causes severe acne and fluid retention, as well as several effects that are gender- and age-specific:

- For *men*—shrinkage of the testicles (testicular atrophy), reduced sperm count or infertility, baldness, development of breasts (gynecomastia), increased risk for prostate cancer
- For *women*—growth of facial hair, male-pattern baldness, changes in or cessation of the menstrual cycle, enlargement of the clitoris, deepened voice
- For *adolescents*—stunted growth due to premature skeletal maturation and accelerated puberty changes, and risk of not reaching expected height if steroid use precedes the typical adolescent growth spurt

In addition, people who inject steroids run the added risk of contracting or transmitting HIV/AIDS or hepatitis.

### Learn More

For more information on AAS, visit <http://www.drugabuse.gov/publications/research-reports/anabolic-steroid-abuse>

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## Synthetic Cathinones ( Bath Salts )

The term **bath salts** refers to an emerging family of drugs containing one or more synthetic chemicals related to cathinone, an amphetamine-like stimulant found naturally in the Khat plant.

Reports of severe intoxication and dangerous health effects associated with use of bath salts have made these drugs a serious and growing public health and safety issue. The synthetic cathinones in bath salts can produce euphoria and increased sociability and sex drive, but some users experience paranoia, agitation, and hallucinatory delirium; some even display psychotic and violent behavior, and deaths have been reported in several instances.

### In Name Only

The synthetic cathinone products marketed as **bath salts** to evade detection by authorities should not be confused with products such as Epsom salts that are sold to improve the experience of bathing. The latter have no psychoactive (drug-like) properties.

Bath salts typically take the form of a white or brown crystalline powder and are sold in small plastic or foil packages labeled **not for human consumption**. Sometimes also marketed as **plant food** or, more recently, as **jewelry cleaner** or **phone screen cleaner**

they are sold online and in drug paraphernalia stores under a variety of brand names, such as **Ivory Wave**, **"Bloom"**, **"Cloud Nine"**, **"Lunar Wave"**, **"Vanilla Sky"**, **"White Lightning"**, and **Scarface**.



### How Are Bath Salts Abused?

Bath salts are typically taken orally, inhaled, or injected, with the worst outcomes being associated with snorting or needle injection.

### How Do Bath Salts Affect the Brain?

Common synthetic cathinones found in bath salts include 3,4-methylenedioxypyrovalerone (MDPV), mephedrone ( **Drone**, **Meph**, or **Meow Meow** ), and methylone, but there are many others. Much is still unknown

### An Evolving Threat

When bath salts emerged at the end of the last decade, they rapidly gained popularity in the U.S. and Europe as legal highs. In October 2011, the U.S. Drug Enforcement Administration placed three common synthetic cathinones under emergency ban pending further investigation, and in July 2012, President Obama signed legislation permanently making two of them mephedrone and MDPV illegal, along with several other synthetic drugs often sold as marijuana substitutes ( [Spice](#) ).

Although the new law also prohibits chemically similar analogues of the named drugs, manufacturers are expected to respond by creating new drugs different enough from the banned substances to evade legal restriction. After mephedrone was banned in the United Kingdom in 2010, for example, a chemical called naphyrone quickly replaced it, and is now being sold as jewelry cleaner under the brand name Cosmic Blast.

about how these substances affect the human brain, and each one may have somewhat different properties. Chemically, they are similar to amphetamines (such as methamphetamine) as well as to MDMA (ecstasy).

The energizing and often agitating effects reported in people who have taken bath salts are consistent with other drugs like amphetamines and cocaine that raise the level of the neurotransmitter dopamine in brain circuits regulating reward and movement. A surge in dopamine in these circuits causes feelings of euphoria and increased activity. A similar surge of the transmitter norepi-

nephrine can raise heart rate and blood pressure. Bath salts have been marketed as cheap (and until recently, legal see Box) substitutes for those stimulants. A recent study found that MDPV the most common synthetic cathinone found in the blood and urine of patients admitted to emergency departments after bath salts ingestion raises brain dopamine in the same manner as cocaine but is at least 10 times more potent.

The hallucinatory effects often reported in users of bath salts are consistent with other drugs such as MDMA or LSD that raise levels of another neurotransmitter, serotonin. A recent analysis of the effects in rats of mephedrone and methydone showed that these drugs raised levels of serotonin in a manner similar to MDMA.

### What Are the Other Health Effects of Bath Salts?

Bath salts have been linked to an alarming surge in visits to emergency departments and poison control centers across the country. Common reactions reported for people who have needed medical attention after using bath salts include cardiac symptoms (such as racing heart, high blood pressure, and chest pains) and psychiatric symptoms including paranoia, hallucinations, and panic attacks.

Patients with the syndrome known as excited delirium from taking bath salts also may have dehydration, breakdown of skeletal muscle tissue, and kidney failure. Intoxication from several synthetic cathinones including MDPV, mephedrone, methedrone, and butylone has proved fatal in several instances.

Early indications are that synthetic cathinones have a high abuse and addiction potential. In a study of the rewarding and reinforcing effects of MDPV, rats showed self-administration patterns and

escalation of drug intake nearly identical to methamphetamine. Bath salts users have reported that the drugs trigger intense cravings (or a compulsive urge to use the drug again) and that they are highly addictive. Frequent consumption may induce tolerance, dependence, and strong withdrawal symptoms when not taking the drug.

The dangers of bath salts are compounded by the fact that these products may contain other, unknown ingredients that may have their own harmful effects.

Also, drug users who believe they are purchasing other drugs such as ecstasy may be in danger of receiving synthetic cathinones instead. For example, mephedrone has been found commonly substituted for MDMA in pills sold as ecstasy in the Netherlands.

### **Learn More**

For additional information on bath salts, please see

<http://www.emcdda.europa.eu/publications/drug-profiles/synthetic-cathinones>

# Drug Facts

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## Cigarettes and Other Tobacco Products

Tobacco use is the leading preventable cause of disease, disability, and death in the United States. According to the Centers for Disease Control and Prevention (CDC), cigarette smoking results in more than 443,000 premature deaths in the United States each year—about 1 in every 5 U.S. deaths<sup>2</sup>—and an additional 8.6 million people suffer with a serious illness caused by smoking.<sup>3</sup> Thus, for every one person who dies from smoking, 20 more suffer from at least one serious tobacco-related illness.<sup>3</sup>

The harmful effects of smoking extend far beyond the smoker. Exposure to secondhand smoke can cause serious diseases and death. Each year, an estimated 126 million Americans are regularly exposed to secondhand smoke and almost 50 thousand nonsmokers die from diseases caused by secondhand smoke exposure.<sup>4</sup>

### How Does Tobacco Affect the Brain?

Cigarettes and other forms of tobacco—including cigars, pipe tobacco, snuff, and chewing tobacco—contain the addictive drug nicotine. Nicotine is readily absorbed into the bloodstream when a tobacco product is chewed, inhaled, or smoked. A typical smoker will take 10 puffs on a cigarette over a period of 5 minutes that the cigarette is lit. Thus, a person

who smokes about 1½ packs (30 cigarettes) daily gets 300 “hits” of nicotine each day.

Upon entering the bloodstream, nicotine immediately stimulates the adrenal glands to release the hormone epinephrine (adrenaline). Epinephrine stimulates the central nervous system and increases blood pressure, respiration, and heart rate.

Like cocaine, heroin, and marijuana, nicotine increases levels of the neurotransmitter dopamine, which affects the brain pathways that control reward and pleasure. For many tobacco users, long-term brain changes induced by continued nicotine exposure result in addiction—a condition of compulsive drug seeking and use, even in the face of negative consequences. Studies suggest that additional compounds in tobacco smoke, such as acetaldehyde, may enhance nicotine’s effects on the brain.<sup>5</sup>

When an addicted user tries to quit, he or she experiences withdrawal symptoms including irritability, attention difficulties, sleep disturbances, increased appetite, and powerful cravings for tobacco. Treatments can help smokers manage these symptoms and improve the likelihood of successfully quitting.

## **What Other Adverse Effects Does Tobacco Have on Health?**

Cigarette smoking accounts for about one-third of all cancers, including 90 percent of lung cancer cases. Smokeless tobacco (such as chewing tobacco and snuff) also increases the risk of cancer, especially oral cancers. In addition to cancer, smoking causes lung diseases such as chronic bronchitis and emphysema, and increases the risk of heart disease, including stroke, heart attack, vascular disease, and aneurysm. Smoking has also been linked to leukemia, cataracts, and pneumonia.<sup>1,2</sup> On average, adults who smoke die 14 years earlier than nonsmokers.<sup>2</sup>

Although nicotine is addictive and can be toxic if ingested in high doses, it does not cause cancer—other chemicals are responsible for most of the severe health consequences of tobacco use. Tobacco smoke is a complex mixture of chemicals such as carbon monoxide, tar, formaldehyde, cyanide, and ammonia—many of which are known carcinogens. Carbon monoxide increases the chance of cardiovascular diseases. Tar exposes the user to an increased risk of lung cancer, emphysema, and bronchial disorders.

Pregnant women who smoke cigarettes run an increased risk of miscarriage, stillborn or premature infants, or infants with low birthweight<sup>2</sup>. Maternal smoking may also be associated with learning and behavioral problems in children. Smoking more than one pack of cigarettes per day during pregnancy nearly doubles the risk that the affected child will become addicted to tobacco if that child starts smoking.<sup>6</sup>

While we often think of medical consequences that result from direct use of tobacco products, passive or secondary smoke also increases the risk for many diseases. Secondhand smoke, also known as environmental tobacco smoke, consists of exhaled smoke and smoke given off by the burning end of tobacco products.

Nonsmokers exposed to secondhand smoke at home or work increase their risk of developing heart disease by 25 to 30 percent<sup>7</sup> and lung cancer by 20 to 30 percent.<sup>2</sup> In addition, secondhand smoke causes respiratory problems, such as coughing, overproduction of phlegm, and reduced lung function and respiratory infections, including pneumonia and bronchitis, in both adults and children. In fact, each year about 150,000 – 300,000 children younger than 18 months old experience respiratory tract infections caused by secondhand smoke.<sup>4</sup> Children exposed to secondhand smoking are at an increased risk for sudden infant death syndrome, ear problems, and severe asthma. Furthermore, children who grow up with parents who smoke are more likely to become smokers, thus placing themselves (and their future families) at risk for the same health problems as their parents when they become adults.

Although quitting can be difficult, the health benefits of smoking cessation are immediate and substantial—including reduced risk for cancers, heart disease, and stroke. A 35-year-old man who quits smoking will, on average, increase his life expectancy by 5 years<sup>8</sup>.

## **Are There Effective Treatments for Tobacco Addiction?**

Tobacco addiction is a chronic disease that often requires multiple attempts to quit. Although some smokers are able to quit without help, many others need assistance. Both behavioral interventions (counseling) and medication can help smokers quit; but the combination of medication with counseling is more effective than either alone.

### **Behavioral Treatments**

Behavioral treatments employ a variety of methods to assist smokers in quitting, ranging from self-help materials to individual counseling. These interventions teach individuals to recognize high-risk situations and

develop coping strategies to deal with them. The U.S. Department of Health and Human Services' (HHS) has established a national toll-free quitline, 800-QUIT-NOW, to serve as an access point for any smoker seeking information and assistance in quitting. NIDA is also supporting research to expand the availability of behavioral therapies by developing interventions using alternative delivery formats, such as web-, computer-, PDA- or text-based modalities, all of which may benefit hard-to-reach populations and increase access to treatment options for millions of smokers.

#### **Nicotine Replacement Treatments**

Nicotine replacement therapies (NRTs) were the first pharmacological treatments approved by the Food and Drug Administration (FDA) for use in smoking cessation therapy. Current FDA-approved NRT products include nicotine chewing gum, the nicotine transdermal patch, nasal sprays, inhalers, and lozenges. NRTs deliver a controlled dose of nicotine to a smoker in order to relieve withdrawal symptoms during the smoking cessation process. They are most successful when used in combination with behavioral treatments.

#### **Other Medications**

Bupropion and varenicline are two FDA-approved non-nicotine medications that effectively increase rates of long-term abstinence from smoking. Bupropion, a medication that goes by the trade name Zyban, was approved by the FDA in 1997 for use in smoking cessation. Varenicline tartrate (trade name: Chantix) targets nicotine receptors in the brain, easing withdrawal symptoms and blocking the effects of nicotine if people resume smoking.

#### **Current Treatment Research**

Scientists are currently pursuing many other avenues of research to develop new smoking cessation therapies. One promising type of intervention in development is a nicotine vaccine, which would induce a strong immune

response to nicotine in the bloodstream, blocking its access to the brain and thereby preventing its reinforcing effects.

### **How Widespread Is Tobacco Use?**

#### **Monitoring the Future Survey†**

Current smoking rates among 8th-, 10th-, and 12th-grade students reached an all-time low in 2012. According to the Monitoring the Future survey, 4.9 percent of 8th-graders, 10.8 percent of 10th graders, and 17.1 percent of 12th-graders reported they had used cigarettes in the past month. Although unacceptably high numbers of youth continue to smoke, these numbers represent a significant decrease from peak smoking rates (21 percent in 8th-graders, 30 percent in 10th-graders, and 37 percent in 12th-graders) that were reached in the late 1990s.

The use of hookahs has also remained steady at high levels since its inclusion in the survey in 2010—past year use was reported by 18.3% of high school seniors. Meanwhile, past year use of small cigars has declined since 2010 yet remains high with 19.9% of 12<sup>th</sup> graders reporting past year use. Current use of smokeless tobacco remained steady among all grades in 2012—2.8 percent of 8th graders, 6.4 percent of 10th graders, and 7.9 percent of 12<sup>th</sup> graders reported past month use.

#### **National Survey on Drug Use and Health (NSDUH)††**

In 2011, 26.5 percent of the U.S. population age 12 and older (approximately 68.2 million people) used a tobacco product at least once in the month prior to being interviewed. This figure includes 2.5 million young people aged 12 to 17 (10 percent of this age group). In addition, almost 56.8 million Americans (22.1 percent of the population) were current cigarette smokers; 12.9 million smoked cigars; more than 8.2 million used smokeless tobacco; and over 2.1 million smoked tobacco in pipes.



## Learn More

For additional information on tobacco abuse and addiction, please visit [www.smoking.drugabuse.gov](http://www.smoking.drugabuse.gov). For more information on how to quit smoking, please visit [www.smokefree.gov](http://www.smokefree.gov).

## Data Sources

† These data are from the 2012 Monitoring the Future survey, funded by the National Institute on Drug Abuse, National Institutes of Health, Department of Health and Human Services, and conducted annually by the University of Michigan's Institute for Social Research. The survey has tracked 12th-graders' illicit drug use and related attitudes since 1975; in 1991, 8th- and 10th-graders were added to the study.

†† NSDUH (formerly known as the National Household Survey on Drug Abuse) is an annual survey of Americans aged 12 and older conducted by the Substance Abuse and Mental Health Services Administration, Department of Health and Human Services. This survey is available on line at [www.samhsa.gov](http://www.samhsa.gov) and can be ordered by phone from NIDA at 877-643-2644.

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# MDMA INFOFACTS

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## Club Drugs (GHB, Ketamine, and Rohypnol)

Club drugs are a pharmacologically heterogeneous group of psychoactive drugs that tend to be abused by teens and young adults at bars, nightclubs, concerts, and parties. Gamma hydroxybutyrate (GHB), Rohypnol, ketamine, as well as MDMA (ecstasy) and methamphetamine (which are featured in separate *InfoFacts*) are some of the drugs included in this group.

GHB (Xyrem) is a central nervous system (CNS) depressant that was approved by the Food and Drug Administration (FDA) in 2002 for use in the treatment of narcolepsy (a sleep disorder). This approval came with severe restrictions, including its use *only* for the treatment of narcolepsy, and the requirement for a patient registry monitored by the FDA. GHB is also a metabolite of the inhibitory neurotransmitter gamma-aminobutyric acid (GABA). It exists naturally in the brain, but at much lower concentrations than those found when GHB is abused.

- Rohypnol (flunitrazepam) use began gaining popularity in the United States in the early 1990s. It is a benzodiazepine (chemically similar to sedative-hypnotic drugs such as Valium or Xanax), but it is not approved for medical use in this country, and its importation is banned.

- Ketamine is a dissociative anesthetic, mostly used in veterinary practice.

### How Are Club Drugs Abused?

- GHB and Rohypnol are available in odorless, colorless, and tasteless forms that are frequently combined with alcohol and other beverages. Both drugs have been used to commit sexual assaults (also known as "date rape," "drug rape," "acquaintance rape," or "drug-assisted" assault) due to their ability to sedate and incapacitate unsuspecting victims, preventing them from resisting sexual assault.
- GHB is usually ingested orally, either in liquid or powder form, while Rohypnol is typically taken orally in pill form. Recent reports, however, have shown that Rohypnol is being ground up and snorted.
- Both GHB and Rohypnol are also abused for their intoxicating effects, similar to other CNS depressants.
- GHB also has anabolic effects (it stimulates protein synthesis) and has been used by bodybuilders to aid in fat reduction and muscle building.
- Ketamine is usually snorted or injected intramuscularly.

## How Do Club Drugs Affect the Brain?

- GHB acts on at least two sites in the brain: the GABA<sub>B</sub> receptor and a specific GHB binding site. At high doses, GHB's sedative effects may result in sleep, coma, or death.
- Rohypnol, like other benzodiazepines, acts at the GABAA receptor. It can produce anterograde amnesia, in which individuals may not remember events they experienced while under the influence of the drug.
- Ketamine is a dissociative anesthetic, so called because it distorts perceptions of sight and sound and produces feelings of detachment from the environment and self. Ketamine acts on a type of glutamate receptor (NMDA receptor) to produce its effects, which are similar to those of the drug PCP.<sup>1,2</sup> Low-dose intoxication results in impaired attention, learning ability, and memory. At higher doses, ketamine can cause dreamlike states and hallucinations; and at higher doses still, ketamine can cause delirium and amnesia.

### **Addictive Potential**

- Repeated use of GHB may lead to withdrawal effects, including insomnia, anxiety, tremors, and sweating. Severe

withdrawal reactions have been reported among patients presenting from an overdose of GHB or related compounds, especially if other drugs or alcohol are involved.<sup>3</sup>

- Like other benzodiazepines, chronic use of Rohypnol can produce tolerance, physical dependence, and addiction.
- There have been reports of people binging on ketamine, a behavior that is similar to that seen in some cocaine- or amphetamine-dependent individuals. Ketamine users can develop signs of tolerance and cravings for the drug.<sup>4</sup>

## What Other Adverse Effects Do Club Drugs Have on Health?

Uncertainties about the sources, chemicals, and possible contaminants used to manufacture many club drugs make it extremely difficult to determine toxicity and associated medical consequences. Nonetheless, we do know that:

- Coma and seizures can occur following use of GHB. Combined use with other drugs such as alcohol can result in nausea and breathing difficulties. GHB and two of its precursors, gamma butyrolactone (GBL) and 1,4 butanediol (BD), have been involved in poisonings, overdoses, date rapes, and deaths.

- Rohypnol may be lethal when mixed with alcohol and/or other CNS depressants.
- Ketamine, in high doses, can cause impaired motor function, high blood pressure, and potentially fatal respiratory problems.

### **What Treatment Options Exist?**

There is very little information available in the scientific literature about treatment for persons who abuse or are dependent upon club drugs.

- There are no GHB detection tests for use in emergency rooms, and as many clinicians are unfamiliar with the drug, many GHB incidents likely go undetected. According to case reports, however, patients who abuse GHB appear to present both a mixed picture of severe problems upon admission and a good response to treatment, which often involves residential services.<sup>3</sup>
- Treatment for Rohypnol follows accepted protocols for any benzodiazepine, which may consist of a 3- to 5-day inpatient detoxification program with 24-hour intensive medical monitoring and management of withdrawal symptoms, since withdrawal from benzodiazepines can be life-threatening.<sup>3</sup>

- Patients with a ketamine overdose are managed through supportive care for acute symptoms, with special attention to cardiac and respiratory functions.<sup>5</sup>

### **How Widespread Is Club Drug Abuse?**

#### ***Monitoring the Future Survey***

MTF has reported consistently low levels of abuse of these club drugs since they were added to the survey. For GHB and ketamine, this occurred in 2000; for Rohypnol, 1996. According to results of the 2009 MTF survey, 0.7 percent of 8th-grade and 1.1 percent of 12th-grade students reported past-year<sup>††</sup> use of GHB, a statistically significant decrease from peak-year use of 1.2 percent in 2000 for 8th-graders and 2.0 percent for 12th-graders in 2004. GHB use among 10th-grade students was reported at 1.0 percent, an increase from 2008 (0.5 percent), and statistically unchanged from peak use of 1.4 percent in 2002 and 2003.

Past-year use of ketamine was reported by 1.0 percent of 8th-graders, 1.3 percent of 10th-graders, and 1.7 percent of 12th-graders in 2009. These percentages also represent significant decreases from peak years: 2000 for 8th-graders (at 1.6 percent) and 2002 for 10th- and 12th-graders (at 2.2 and 2.6 percent, respectively).

For Rohypnol, 0.4 percent of 8th- and 10th-graders, and 1.0 percent of 12th-graders reported past-year use, also down from peak use in 1996 for 8th-graders (1.0 percent), 1997 for 10th-graders (1.3 percent), and 2002 and 2004 for 12th-graders (1.6 percent).

### Other Information Sources

For more information about club drugs, visit [www.clubdrugs.gov](http://www.clubdrugs.gov), [www.teens.drugabuse.gov](http://www.teens.drugabuse.gov), and [www.backtoschool.drugabuse.gov](http://www.backtoschool.drugabuse.gov); or call NIDA at 877-643-2644. For street terms searchable by drug name, street term, cost and quantities, drug trade, and drug use, visit <http://www.whitehousedrugpolicy.gov/streetterms/default.asp>.

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### Data Sources

<sup>1</sup> These data are from the 2009 Monitoring the Future survey, funded by the National Institute on Drug Abuse, National Institutes of Health, Department of Health and Human Services, and conducted annually by the University of Michigan's Institute for Social Research. The survey has tracked 12th-graders' illicit drug use and related attitudes since 1975; in 1991, 8th- and 10th-graders were added to the study.

<sup>††</sup> "Lifetime" refers to use at least once during a respondent's lifetime. "Past year" refers to use at least once during the year preceding an individual's response to the survey. "Past month" refers to use at least once during the 30 days preceding an individual's response to the survey.

### Resources

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<sup>2</sup> Kapur S, Seeman P. NMDA receptor antagonists ketamine and PCP have direct effects on dopamine D2 and serotonin 5-HT2 receptors – Implications for models of schizophrenia. *Molecular Psychiatry* 7: 837-844, 2002.

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# Drug Facts

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## Cocaine

Cocaine is a powerfully addictive stimulant drug made from the leaves of the coca plant native to South America. It produces short-term euphoria, energy, and talkativeness in addition to potentially dangerous physical effects like raising heart rate and blood pressure.



### How Is Cocaine Used?

The powdered form of cocaine is either inhaled through the nose (snorted), where it is absorbed through the nasal tissue, or dissolved in water and injected into the bloodstream.

Crack is a form of cocaine that has been processed to make a rock crystal (also called “freebase cocaine”) that can be smoked. The crystal is heated to produce vapors that are absorbed into the bloodstream through the lungs. (The term “crack” refers to the crackling sound produced by the rock as it is heated.)

The intensity and duration of cocaine’s pleasurable effects depend on the way it is

administered. Injecting or smoking cocaine delivers the drug rapidly into the bloodstream and brain, producing a quicker and stronger but shorter-lasting high than snorting. The high from snorting cocaine may last 15 to 30 minutes; the high from smoking may last 5 to 10 minutes.

In order to sustain their high, people who use cocaine often use the drug in a binge pattern—taking the drug repeatedly within a relatively short period of time, at increasingly higher doses. This practice can easily lead to addiction, a chronic relapsing disease caused by changes in the brain and characterized by uncontrollable drug-seeking no matter the consequences.

### How Does Cocaine Affect the Brain?

Cocaine is a strong central nervous system stimulant that increases levels of the neurotransmitter dopamine in brain circuits regulating pleasure and movement.

Normally, dopamine is released by neurons in these circuits in response to potential rewards (like the smell of good food) and then recycled back into the cell that released it, thus shutting off the signal between neurons. Cocaine prevents the dopamine from being recycled, causing excessive amounts to build up in the synapse, or junction between neurons. This amplifies the dopamine signal and

ultimately disrupts normal brain communication. It is this flood of dopamine that causes cocaine's characteristic high.

With repeated use, cocaine can cause long-term changes in the brain's reward system as well as other brain systems, which may lead to addiction. With repeated use, tolerance to cocaine also often develops; many cocaine abusers report that they seek but fail to achieve as much pleasure as they did from their first exposure. Some users will increase their dose in an attempt to intensify and prolong their high, but this can also increase the risk of adverse psychological or physiological effects.

### **What Are the Other Health Effects of Cocaine?**

Cocaine affects the body in a variety of ways. It constricts blood vessels, dilates pupils, and increases body temperature, heart rate, and blood pressure. It can also cause headaches and gastrointestinal complications such as abdominal pain and nausea. Because cocaine tends to decrease appetite, chronic users can become malnourished as well.

Most seriously, people who use cocaine can suffer heart attacks or strokes, which may cause sudden death. Cocaine-related deaths are often a result of the heart stopping (cardiac arrest) followed by an arrest of breathing.

People who use cocaine also put themselves at risk for contracting HIV, even if

they do not share needles or other drug paraphernalia. This is because cocaine intoxication impairs judgment and can lead to risky sexual behavior.

Some effects of cocaine depend on the method of taking it. Regular snorting of cocaine, for example, can lead to loss of the sense of smell, nosebleeds, problems with swallowing, hoarseness, and a chronically runny nose. Ingesting cocaine by the mouth can cause severe bowel gangrene as a result of reduced blood flow. Injecting cocaine can bring about severe allergic reactions and increased risk for contracting HIV, hepatitis C, and other blood-borne diseases.

Binge-patterned cocaine use may lead to irritability, restlessness, and anxiety. Cocaine abusers can also experience severe paranoia—a temporary state of full-blown paranoid psychosis—in which they lose touch with reality and experience auditory hallucinations.

Cocaine is more dangerous when combined with other drugs or alcohol (poly-drug use). For example, the combination of cocaine and heroin (known as a "speedball"), carries a particularly high risk of fatal overdose.

### **Learn More**

For additional information on cocaine, please see <http://www.drugabuse.gov/publication/research-reports/cocaine-abuse-addiction>

# Drug Facts

[www.drugabuse.gov](http://www.drugabuse.gov)

## MDMA (“Ecstasy”)

MDMA (3,4-methylenedioxy-methamphetamine), popularly known as ecstasy, is a synthetic, psychoactive drug that has similarities to both the stimulant amphetamine and the hallucinogen mescaline. It produces feelings of increased energy, euphoria, emotional warmth and empathy toward others, and distortions in sensory and time perception.

MDMA was initially popular among White adolescents and young adults in the nightclub scene or at “raves” (long dance parties), but the drug now affects a broader range of users and ethnicities.

### How Is MDMA Abused?

MDMA is taken orally, usually as a capsule or tablet. Its effects last approximately 3 to 6 hours, although it is not uncommon for users to take a second dose of the drug as the effects of the first dose begin to fade. It is commonly taken in combination with other drugs. For example some urban gay and bisexual men report using MDMA as part of a multiple-drug experience that includes cocaine, GHB, methamphetamine, ketamine, and the erectile-dysfunction drug sildenafil (Viagra).

### How Does MDMA Affect the Brain?

MDMA acts by increasing the activity of three neurotransmitters, serotonin, dopamine, and norepinephrine. The emotional and pro-social effects of MDMA are likely caused directly or indirectly by the release of large amounts of serotonin, which influences mood (as well as other functions such as appetite and sleep). Serotonin also triggers the release of the hormones oxytocin and vasopressin, which play important roles in

### Is MDMA Addictive?

Research thus far on MDMA’s addictive properties has shown varying results, but we do know that some users report symptoms of dependence, including continued use despite knowledge of physical or psychological harm, tolerance (or diminished response), and withdrawal effects.

The neurotransmitter systems targeted by MDMA are the same as those targeted by other addictive drugs. Experiments have shown that animals will self-administer MDMA—an important indicator of a drug’s abuse potential—although the degree of self-administration is less than some other drugs of abuse such as cocaine.



love, trust, sexual arousal, and other social experiences. This may account for the characteristic feelings of emotional closeness and empathy produced by the drug; studies in both rats and humans have shown that MDMA raises the levels of these hormones.

The surge of serotonin caused by taking MDMA depletes the brain of this important chemical, however, causing negative aftereffects—including confusion, depression, sleep problems, drug craving, and anxiety—that may occur soon after taking the drug or during the days or even weeks thereafter.

Some heavy MDMA users experience long-lasting confusion, depression, sleep abnormalities, and problems with attention and memory, although it is possible that some of these effects may be due to the use of other drugs in combination with MDMA (especially marijuana).

### **What Are the Other Health Effects of MDMA?**

MDMA can have many of the same physical effects as other stimulants like cocaine and amphetamines. These include increases in heart rate and blood pressure, which are particularly risky for people with circulatory problems or heart disease. MDMA users may experience other symptoms such as muscle tension, involuntary teeth clenching, nausea, blurred vision, faintness, and chills or sweating.

In high doses, MDMA can interfere with the body's ability to regulate temperature. On rare but unpredictable occasions, this can lead to a sharp increase in body temperature (hyperthermia), which can result in liver, kidney, or cardiovascular system failure or even death. MDMA can interfere with its own metabolism (breakdown within the body), causing potentially harmful levels to

build up in the body if it is taken repeatedly within short periods of time.

Compounding the risks of ecstasy use is the fact that other potentially harmful drugs (including synthetic cathinones, the psychoactive ingredients in “bath salts”) are sometimes sold as ecstasy. These drugs can be neurotoxic or pose other unpredictable health risks. And ecstasy tablets that do contain MDMA may contain additional substances such as ephedrine (a stimulant), dextromethorphan (a cough suppressant), ketamine, caffeine, cocaine, or methamphetamine. The combination of MDMA with one or more of these drugs may be hazardous. Users who intentionally or unknowingly combine such a mixture with additional substances such as marijuana and alcohol may be putting themselves at even higher risk for adverse health effects.

Additionally, the closeness-promoting effects of MDMA and its use in sexually charged contexts (and especially in com-

### **Does MDMA Have Therapeutic Value?**

MDMA was first used in the 1970s, not as a recreational drug but as an aid in psychotherapy—although without the support of clinical trial research or FDA approval. In 1985, the Drug Enforcement Administration labeled MDMA a Schedule I substance, or a drug with high abuse potential and no recognized medicinal use. Some researchers remain interested in its potential therapeutic value when administered under carefully monitored conditions. It is currently in clinical trials as a possible pharmacotherapy aid to treat post-traumatic stress disorder (PTSD) and anxiety in terminal cancer patients.

ination with sildenafil) may encourage unsafe sex, which is a risk factor for contracting or spreading HIV and hepatitis.

### **Learn More**

For additional information on MDMA, please see <http://www.drugabuse.gov/publications/research-reports/mdma-ecstasy-abuse>

## Hallucinogens: LSD, Peyote, Psilocybin, and PCP

Hallucinogenic compounds found in some plants and mushrooms (or their extracts) have been used—mostly during religious rituals—for centuries. Almost all hallucinogens contain nitrogen and are classified as alkaloids. Many hallucinogens have chemical structures similar to those of natural neurotransmitters (e.g., acetylcholine-, serotonin-, or catecholamine-like). While the exact mechanisms by which hallucinogens exert their effects remain unclear, research suggests that these drugs work, at least partially, by temporarily interfering with neurotransmitter action or by binding to their receptor sites. This *InfoFacts* will discuss four common types of hallucinogens:

- **LSD** (d-lysergic acid diethylamide) is one of the most potent mood-changing chemicals. It was discovered in 1938 and is manufactured from lysergic acid, which is found in ergot, a fungus that grows on rye and other grains.
- **Peyote** is a small, spineless cactus in which the principal active ingredient is mescaline. This plant has been used by natives in northern Mexico and the southwestern United States as a part of religious ceremonies. Mescaline can also be produced through chemical synthesis.

- **Psilocybin** (4-phosphoryloxy-*N,N*-dimethyltryptamine) is obtained from certain types of mushrooms that are indigenous to tropical and subtropical regions of South America, Mexico, and the United States. These mushrooms typically contain less than 0.5 percent psilocybin plus trace amounts of psilocin, another hallucinogenic substance.
- **PCP** (phencyclidine) was developed in the 1950s as an intravenous anesthetic. Its use has since been discontinued due to serious adverse effects.

### How Are Hallucinogens Abused?

The very same characteristics that led to the incorporation of hallucinogens into ritualistic or spiritual traditions have also led to their propagation as drugs of abuse. Importantly, and unlike most other drugs, the effects of hallucinogens are highly variable and unreliable, producing different effects in different people at different times. This is mainly due to the significant variations in amount and composition of active compounds, particularly in the hallucinogens derived from plants and mushrooms. Because of

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their unpredictable nature, the use of hallucinogens can be particularly dangerous.

- **LSD** is sold in tablets, capsules, and, occasionally, liquid form; thus, it is usually taken orally. LSD is often added to absorbent paper, which is then divided into decorated pieces, each equivalent to one dose. The experiences, often referred to as "trips," are long; typically, they end after about 12 hours.
- **Peyote.** The top of the peyote cactus, also referred to as the crown, consists of disc-shaped buttons that are cut from the roots and dried. These buttons are generally chewed or soaked in water to produce an intoxicating liquid. The hallucinogenic dose of mescaline is about 0.3 to 0.5 grams, and its effects last about 12 hours. Because the extract is so bitter, some individuals prefer to prepare a tea by boiling the cacti for several hours.
- **Psilocybin.** Mushrooms containing psilocybin are available fresh or dried and are typically taken orally. Psilocybin (4-phosphoryloxy-*N,N*-dimethyltryptamine) and its biologically active form, psilocin (4-hydroxy-*N,N*-dimethyltryptamine), cannot be inactivated by cooking or freezing preparations. Thus, they may also be brewed as a tea or added to other foods to mask their bitter flavor. The effects of psilocybin, which appear within 20 minutes of ingestion, last approximately 6 hours.

- **PCP** is a white crystalline powder that is readily soluble in water or alcohol. It has a distinctive bitter chemical taste. PCP can be mixed easily with dyes and is often sold on the illicit drug market in a variety of tablet, capsule, and colored powder forms that are normally snorted, smoked, or orally ingested. For smoking, PCP is often applied to a leafy material such as mint, parsley, oregano, or marijuana. Depending upon how much and by what route PCP is taken, its effects can last approximately 4–6 hours.

## How Do Hallucinogens Affect the Brain?

LSD, peyote, psilocybin, and PCP are drugs that cause hallucinations, which are profound distortions in a person's perception of reality. Under the influence of hallucinogens, people see images, hear sounds, and feel sensations that seem real but are not. Some hallucinogens also produce rapid, intense emotional swings. LSD, peyote, and psilocybin cause their effects by initially disrupting the interaction of nerve cells and the neurotransmitter serotonin.<sup>1</sup> Distributed throughout the brain and spinal cord, the serotonin system is involved in the control of behavioral, perceptual, and regulatory systems, including mood, hunger, body temperature, sexual behavior, muscle control, and sensory perception. On the other hand, PCP acts mainly through a type of glutamate receptor in the brain that is important for the perception of

pain, responses to the environment, and learning and memory.

There have been no properly controlled research studies on the specific effects of these drugs on the *human* brain, but smaller studies and several case reports have been published documenting some of the effects associated with the use of hallucinogens.

- **LSD.** Sensations and feelings change much more dramatically than the physical signs in people under the influence of LSD. The user may feel several different emotions at once or swing rapidly from one emotion to another. If taken in large enough doses, the drug produces delusions and visual hallucinations. The user's sense of time and self is altered. Experiences may seem to "cross over" different senses, giving the user the feeling of hearing colors and seeing sounds. These changes can be frightening and can cause panic. Some LSD users experience severe, terrifying thoughts and feelings of despair, fear of losing control, or fear of insanity and death while using LSD.

LSD users can also experience flashbacks, or recurrences of certain aspects of the drug experience. Flashbacks occur suddenly, often without warning, and may occur within a few days or more than a year after LSD use. In some individuals, the flashbacks can persist and cause significant distress or impairment in social or occupational functioning,

a condition known as hallucinogen-induced persisting perceptual disorder (HPPD).

Most users of LSD voluntarily decrease or stop its use over time. LSD is not considered an addictive drug since it does not produce compulsive drug-seeking behavior. However, LSD does produce tolerance, so some users who take the drug repeatedly must take progressively higher doses to achieve the state of intoxication that they had previously achieved. This is an extremely dangerous practice, given the unpredictability of the drug. In addition, cross-tolerance between LSD and other hallucinogens has been reported.

- **Peyote.** The long-term residual psychological and cognitive effects of mescaline, peyote's principal active ingredient, remain poorly understood. A recent study found no evidence of psychological or cognitive deficits among Native Americans that use peyote regularly in a religious setting.<sup>2</sup> It should be mentioned, however, that these findings may not generalize to those who repeatedly abuse the drug for recreational purposes. Peyote abusers may also experience flashbacks.
- **Psilocybin.** The active compounds in psilocybin-containing "magic" mushrooms have LSD-like properties and produce alterations of autonomic function, motor reflexes, behavior, and perception.<sup>3</sup> The psychological

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consequences of psilocybin use include hallucinations, an altered perception of time, and an inability to discern fantasy from reality. Panic reactions and psychosis also may occur, particularly if a user ingests a large dose. Long-term effects such as flashbacks, risk of psychiatric illness, impaired memory, and tolerance have been described in case reports.

- **PCP.** The use of PCP as an approved anesthetic in humans was discontinued in 1965 because patients often became agitated, delusional, and irrational while recovering from its anesthetic effects. PCP is a "dissociative drug," meaning that it distorts perceptions of sight and sound and produces feelings of detachment (dissociation) from the environment and self. First introduced as a street drug in the 1960s, PCP quickly gained a reputation as a drug that could cause bad reactions and was not worth the risk. However, some abusers continue to use PCP due to the feelings of strength, power, and invulnerability as well as a numbing effect on the mind that PCP can induce. Among the adverse psychological effects reported are—
  - o Symptoms that mimic schizophrenia, such as delusions, hallucinations, paranoia, disordered thinking, and a sensation of distance from one's environment.
  - o Mood disturbances: Approximately 50 percent of individuals brought to

emergency rooms because of PCP-induced problems—related to use within the past 48 hours—report significant elevations in anxiety symptoms.<sup>4</sup>

- o People who have abused PCP for long periods of time have reported memory loss, difficulties with speech and thinking, depression, and weight loss. These symptoms can persist up to one year after stopping PCP abuse.
- o Addiction: PCP is addictive—its repeated abuse can lead to craving and compulsive PCP-seeking behavior, despite severe adverse consequences.

## What Other Adverse Effects Do Hallucinogens Have on Health?

Unpleasant adverse effects as a result of the use of hallucinogens are not uncommon. These may be due to the large number of psychoactive ingredients in any single source of hallucinogen.<sup>3</sup>

- **LSD.** The effects of LSD depend largely on the amount taken. LSD causes dilated pupils; can raise body temperature and increase heart rate and blood pressure; and can cause profuse sweating, loss of appetite, sleeplessness, dry mouth, and tremors.

- **Peyote.** Its effects can be similar to those of LSD, including increased body temperature and heart rate, uncoordinated movements (ataxia), profound sweating, and flushing. The active ingredient mescaline has also been associated, in at least one report, to fetal abnormalities.<sup>5</sup>
- **Psilocybin.** It can produce muscle relaxation or weakness, ataxia, excessive pupil dilation, nausea, vomiting, and drowsiness. Individuals who abuse psilocybin mushrooms also risk poisoning if one of many existing varieties of poisonous mushrooms is incorrectly identified as a psilocybin mushroom.
- **PCP.** At low to moderate doses, physiological effects of PCP include a slight increase in breathing rate and a pronounced rise in blood pressure and pulse rate. Breathing becomes shallow; flushing and profuse sweating, generalized numbness of the extremities, and loss of muscular coordination may occur.

At high doses, blood pressure, pulse rate, and respiration drop. This may be accompanied by nausea, vomiting, blurred vision, flicking up and down of the eyes, drooling, loss of balance, and dizziness. PCP abusers are often brought to emergency rooms because of overdose or because of the drug's severe untoward psychological effects. While intoxicated, PCP abusers may become violent or suicidal and are therefore dangerous to themselves

and others. High doses of PCP can also cause seizures, coma, and death (though death more often results from accidental injury or suicide during PCP intoxication). Because PCP can also have sedative effects, interactions with other central nervous system depressants, such as alcohol and benzodiazepines, can also lead to coma.

### What Treatment Options Exist?

Treatment for alkaloid hallucinogen (such as psilocybin) intoxication—which is mostly symptomatic—is often sought as a result of bad “trips,” during which a patient may, for example, hurt him- or herself.<sup>6</sup> Treatment is usually supportive: provision of a quiet room with little sensory stimulation. Occasionally, benzodiazepines are used to control extreme agitation or seizures.

There is very little published data on treatment outcomes for PCP intoxication. Doctors should consider that acute adverse reactions may be the result of drug synergy with alcohol.<sup>7</sup> Current research efforts to manage a life-threatening PCP overdose are focused on a passive immunization approach through the development of anti-PCP antibodies.<sup>8</sup> There are no specific treatments for PCP abuse and addiction, but inpatient and/or behavioral treatments can be helpful for patients with a variety of addictions, including that to PCP.

## How Widespread Is the Abuse of Hallucinogens?

According to the National Survey on Drug Use and Health (NSDUH),<sup>†</sup> there were approximately 1.1 million persons aged 12 or older in 2007 who reported using hallucinogens for the first time within the past 12 months.

### LSD

#### Monitoring the Future Survey<sup>††</sup>

There were no significant changes in LSD use from 2007 to 2008 for most prevalence periods among the 8th-, 10th-, and 12th-graders surveyed; however, there was a significant increase in past-month use of LSD among 12th-graders. Perceived risk of harm from taking LSD regularly decreased among 12th-graders (from 67.3 percent in 2007 to 63.6 percent in 2008). No other changes were significant, but longer term trends indicate a steady decline in perceived harmfulness of LSD in all three grades. Such changes in attitude could signal a subsequent increase in use, an outcome that would be of great concern after the large decreases seen since the mid-1990s, when LSD use peaked among youth.

<b>LSD Use by Students 2008 Monitoring the Future Survey</b>			
	<b>8th Grade</b>	<b>10th Grade</b>	<b>12th Grade</b>
Lifetime <sup>†††</sup>	1.9%	2.6%	4.0%
Past Year	1.3%	1.8%	2.7%
Past Month	0.5%	0.7%	1.1%

## National Survey on Drug Use and Health<sup>†</sup>

In 2007, more than 22.7 million persons aged 12 or older reported they had used LSD in their lifetime (9.1 percent); however, fewer than 620,000 had used the drug in the past year. There was no change between 2006 and 2007 in the number of past-year initiates of LSD.

### Peyote and Psilocybin

It is difficult to gauge the extent of use of these hallucinogens because most data sources that quantify drug use exclude these drugs. The Monitoring the Future survey<sup>††</sup> reported in 2008 that 7.8 percent of high school seniors had used hallucinogens other than LSD—a group that includes peyote, psilocybin, and others—at least once in their lifetime. Past-year use was reported to be 5 percent.

### PCP

#### Monitoring the Future Survey<sup>††</sup>

In 2008, 1.8 percent of high school seniors reported lifetime<sup>†††</sup> use of PCP; past-year use was reported by 1.1 percent of seniors; and past-month use was reported by 0.6 percent. Data on PCP use by 8th- and 10th-graders are not available.



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## National Survey on Drug Use and Health†

In 2007, 6.1 million persons aged 12 or older reported that they had used PCP in their lifetime (2.5 percent), although only 137,000 persons in the same age group reported use in the past year—this represents a decrease from 187,000 persons in 2006.

## Other Information Sources

For more information on Hallucinogens, please visit [www.clubdrugs.org](http://www.clubdrugs.org) and [www.teens.drugabuse.gov](http://www.teens.drugabuse.gov).

For street terms searchable by drug name, street term, cost and quantities, drug trade, and drug use, visit [www.whitehousedrugpolicy.gov/streetterms/default.asp](http://www.whitehousedrugpolicy.gov/streetterms/default.asp).

† NSDUH (formerly known as the National Household Survey on Drug Abuse) is an annual survey of Americans age 12 and older conducted by the Substance Abuse and Mental Health Services Administration. Copies of the latest survey are available at [www.samhsa.gov](http://www.samhsa.gov) and from NIDA at 877-643-2644.

†† These data are from the 2008 Monitoring the Future survey, funded by the National Institute on Drug Abuse, National Institutes of Health, Department of Health and Human Services, and conducted annually by the University of Michigan's Institute for Social Research. The survey has tracked 12th-graders' illicit drug use and related attitudes since 1975; in 1991, 8th- and 10th-graders were added to the study. The latest data are online at [www.drugabuse.gov](http://www.drugabuse.gov).

††† "Lifetime" refers to use at least once during a respondent's lifetime. "Past year" refers to use at least once during the year preceding an individual's response to the survey. "Past month" refers to use at least once during the 30 days preceding an individual's response to the survey.

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# Drug Facts

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## Heroin

Heroin is an opioid drug that is synthesized from morphine, a naturally occurring substance extracted from the seed pod of the Asian opium poppy plant. Heroin usually appears as a white or brown powder or as a black sticky substance, known as “black tar heroin.”

In 2011, 4.2 million Americans aged 12 or older (or 1.6 percent) had used heroin at least once in their lives. It is estimated that about 23 percent of individuals who use heroin become dependent on it.

### How Is Heroin Used?

Heroin can be injected, inhaled by snorting or sniffing, or smoked. All three routes of administration deliver the drug to the brain very rapidly, which contributes to its health risks and to its high risk for addiction, which is a chronic relapsing disease caused by changes in the brain and characterized by uncontrollable drug-seeking no matter the consequences.

### How Does Heroin Affect the Brain?

When it enters the brain, heroin is converted back into morphine, which binds to molecules on cells known as opioid receptors. These receptors are located in many areas of the brain (and in the body), especially those involved in the

### Prescription Opioid Abuse: A First Step to Heroin Use?

Prescription opioid pain medications such as Oxycontin and Vicodin can have effects similar to heroin when taken in doses or in ways other than prescribed, and they are currently among the most commonly abused drugs in the United States. Research now suggests that abuse of these drugs may open the door to heroin abuse.

Nearly half of young people who inject heroin surveyed in three recent studies reported abusing prescription opioids before starting to use heroin. Some individuals reported taking up heroin because it is cheaper and easier to obtain than prescription opioids.

Many of these young people also report that crushing prescription opioid pills to snort or inject the powder provided their initiation into these methods of drug administration.

perception of pain and in reward. Opioid receptors are also located in the brain stem, which controls automatic processes critical for life, such as blood pressure, arousal, and respiration. Heroin over-

doses frequently involve a suppression of breathing, which can be fatal.

After an intravenous injection of heroin, users report feeling a surge of euphoria (“rush”) accompanied by dry mouth, a warm flushing of the skin, heaviness of the extremities, and clouded mental functioning. Following this initial euphoria, the user goes “on the nod,” an alternately wakeful and drowsy state. Users who do not inject the drug may not experience the initial rush, but other effects are the same.

Regular heroin use changes the functioning of the brain. One result is tolerance, in which more of the drug is needed to achieve the same intensity of effect. Another result is dependence, characterized by the need to continue use of the drug to avoid withdrawal symptoms.

### **Injection Drug Use and HIV and HCV Infection**

People who inject drugs are at high risk of contracting HIV and hepatitis C (HCV). This is because these diseases are transmitted through contact with blood or other bodily fluids, which can occur when sharing needles or other injection drug use equipment. (HCV is the most common blood-borne infection in the United States.) HIV (and less often HCV) can also be contracted during unprotected sex, which drug use makes more likely.

Because of the strong link between drug abuse and the spread of infectious disease, drug abuse treatment can be an effective way to prevent the latter. People in drug abuse treatment, which often includes risk reduction counseling, stop or reduce their drug use and related risk behaviors, including risky injection practices and unsafe sex. (See box, “Treating Heroin Addiction.”)

### **What Are the Other Health Effects of Heroin?**

Heroin abuse is associated with a number of serious health conditions, including fatal overdose, spontaneous abortion, and infectious diseases like hepatitis and HIV (see box, “Injection Drug Use and HIV and HCV Infection”). Chronic users may develop collapsed veins, infection of the heart lining and valves, abscesses, constipation and gastrointestinal cramping, and liver or kidney disease. Pulmonary complications, including various types of pneumonia, may result from the poor health of the user as well as from heroin’s effects on breathing.

In addition to the effects of the drug itself, street heroin often contains toxic contaminants or additives that can clog blood vessels leading to the lungs, liver, kidneys, or brain, causing permanent damage to vital organs.

Chronic use of heroin leads to physical dependence, a state in which the body has adapted to the presence of the drug. If a dependent user reduces or stops use of the drug abruptly, he or she may experience severe symptoms of withdrawal. These symptoms—which can begin as early as a few hours after the last drug administration—can include restlessness, muscle and bone pain, insomnia, diarrhea and vomiting, cold flashes with goose bumps (“cold turkey”), and kicking movements (“kicking the habit”). Users also experience severe craving for the drug during withdrawal, which can precipitate continued abuse and/or relapse.

Besides the risk of spontaneous abortion, heroin abuse during pregnancy (together with related factors like poor nutrition and inadequate prenatal care) is also associated with low birth weight, an important risk factor for later delays in development. Additionally, if the mother

is regularly abusing the drug, the infant may be born physically dependent on heroin and could suffer from neonatal abstinence syndrome (NAS), a drug withdrawal syndrome in infants that requires hospitalization. According to a recent study, treating opioid-addicted pregnant mothers with buprenorphine (a medication for opioid dependence)

### **Treating Heroin Addiction**

A range of treatments including behavioral therapies and medications are effective at helping patients stop using heroin and return to stable and productive lives.

Medications include **buprenorphine** and **methadone**, both of which work by binding to the same cell receptors as heroin but more weakly, helping a person wean off the drug and reduce craving; and **naltrexone**, which blocks opioid receptors and prevents the drug from having an effect (patients sometimes have trouble complying with naltrexone treatment, but a new long-acting version given by injection in a doctor's office may increase this treatment's efficacy). Another drug called **naloxone** is sometimes used as an emergency treatment to counteract the effects of heroin overdose.

For more information, see NIDA's handbook, [\*Principles of Drug Addiction Treatment\*](#).

can reduce NAS symptoms in babies and shorten their hospital stays.

### **Learn More**

For additional information on heroin, please refer to the following sources on NIDA's Web site:

- [Research Report Series - Heroin Abuse and Addiction](#)
- [NIDA Notes - Heroin](#)
- [NIDA Notes - Opioids](#)

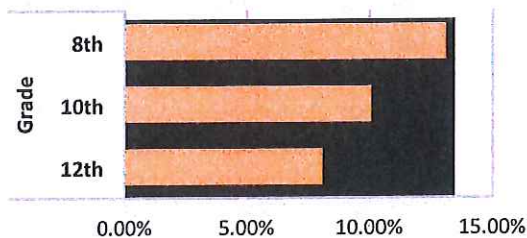
# Drug Facts

[www.drugabuse.gov](http://www.drugabuse.gov)

## Inhalants

Many products readily found in the home or workplace—such as spray paints, markers, glues, and cleaning fluids—contain volatile substances that have psychoactive (mind-altering) properties when inhaled. People do not typically think of these products as drugs because they were never intended for that purpose. However, these products are sometimes abused in that way. They are especially (but not exclusively) abused by young children and adolescents, and are the only class of substance abused more by younger than by older teens.

High-School Students Reporting Having Ever Used Inhalants



Source: University of Michigan, 2011 Monitoring the Future Study. Survey data can be found at [www.drugabuse.gov](http://www.drugabuse.gov)

### How Are Inhalants Abused?

Abusers of inhalants breathe them in through the nose or mouth in a variety of ways (known as “huffing”). They

### Definition

Although other abused drugs can be inhaled, the term **inhalants** is reserved for the wide variety of substances—including solvents, aerosols, gases, and nitrites—that are rarely, if ever, taken via any other route of administration. (See below for a list of examples.)

may sniff or snort fumes from a container or dispenser (such as a glue bottle or a marking pen), spray aerosols (such as computer cleaning dust-ers) directly into their nose or mouth, or place a chemical-soaked rag in their mouth. Abusers may also inhale fumes from a balloon or a plastic or paper bag. Although the high produced by inhalants usually lasts just a few minutes, abusers often try to prolong it by continuing to inhale repeatedly over several hours.

People tend to abuse different inhalant products at different ages. New users ages 12–15 most commonly abuse glue, shoe polish, spray paints, gasoline, and lighter fluid. New users ages 16–17 most commonly abuse nitrous oxide or “whippets.” Adults most commonly abuse a class of inhalants known as nitrites (such as amyl nitrites or “poppers”).

## How Do Inhalants Affect the Brain?

Most abused inhalants other than nitrites depress the central nervous system in a manner not unlike alcohol. The effects are similar—including slurred speech, lack of coordination, euphoria, and dizziness. Inhalant abusers may also experience light-headedness, hallucinations, and delusions. With repeated inhalations, many users feel less inhibited and less in control. Some may feel drowsy for several hours and experience a lingering headache.

Unlike other types of inhalants, nitrites enhance sexual pleasure by dilating and relaxing blood vessels.

Although it is not very common, addiction to inhalants can occur with repeated abuse.

## What Are the Other Health Effects of Inhalants?

Chemicals found in different types of inhaled products may produce a variety of other short-term effects, such as nausea or vomiting, as well as more serious long-term consequences. These may include liver and kidney damage, hearing loss, or bone marrow damage. Effects may also include loss of coordination and limb spasms due to damage to myelin—a protective sheathing around nerve fibers that helps nerves transmit messages in the brain and peripheral nervous system. Inhalants can also cause brain damage by cutting off oxygen flow to the brain.

Inhalants can even be lethal. Sniffing highly concentrated amounts of the chemicals in solvents or aerosol sprays can directly cause heart failure within minutes. This syndrome, known as “sudden sniffing death,” can result from a single session of inhalant use by an otherwise healthy young

## Products Abused as Inhalants

**Volatile solvents**—liquids that vaporize at room temperature:

*Industrial or household products*, including paint thinners or removers, degreasers, dry-cleaning fluids, gasoline, and lighter fluid  
*Art or office supply solvents*, including correction fluids, felt-tip marker fluid, electronic contact cleaners, and glue

**Aerosols**—sprays that contain propellants and solvents:

*Household aerosol propellants* in items such as spray paints, hair or deodorant sprays, fabric protector sprays, aerosol computer cleaning products, and vegetable oil sprays

**Gases**—found in household or commercial products and used as medical anesthetics:

*Household or commercial products*, including butane lighters and propane tanks, whipped cream aerosols or dispensers (“whippets”), and refrigerant gases  
*Medical anesthetics*, such as ether, chloroform, halothane, and nitrous oxide (“laughing gas”)

**Nitrites**—used primarily as sexual enhancers:

*Organic nitrites* are volatiles that include cyclohexyl, butyl, and amyl nitrites, commonly known as “poppers.” Amyl nitrite is still used in certain diagnostic medical procedures. When marketed for illicit use, organic nitrites are often sold in small brown bottles labeled as “video head cleaner,” “room odorizer,” “leather cleaner,” or “liquid aroma.”

person. High concentrations of inhalants may also cause death from suffocation, especially when inhaled from a paper or plastic bag or in a closed area. Even when using aerosols or volatile products for their legitimate purposes like painting or cleaning, it is wise to do so in a well-ventilated room or outdoors.

Nitrites are a special class of inhalants that are abused to enhance sexual pleasure and performance. They can be associated with unsafe sexual practices that increase the risk of contracting and spreading infectious diseases like HIV/AIDS and hepatitis.

## Learn More

For additional information on inhalants and inhalant abuse, please see <http://www.drugabuse.gov/publications/research-reports/inhalant-abuse>

# Drug Facts

[www.drugabuse.gov](http://www.drugabuse.gov)

## Khat

Khat (pronounced "cot") is a stimulant drug derived from a shrub (*Catha edulis*) that is native to East Africa and southern Arabia. The khat plant itself is not scheduled under the Controlled Substances Act; however, because one of the mind-altering chemicals found in it, cathinone, is a Schedule I drug (a controlled substance with no recognized therapeutic use), the Federal Government considers Khat use illegal.



### How Is Khat Used?

Leaves of the khat shrub are typically chewed and held in the cheek, like chewing tobacco, to release their stimulant chemicals.

### How Does Khat Affect the Brain?

The main psychoactive ingredients in khat are cathinone and cathine. These

chemicals are structurally similar to amphetamine and result in similar stimulant effects in the brain and body, although they are less potent. Like other stimulants, cathinone and cathine stimulate the release of the stress hormone and neurotransmitter norepinephrine and raise the level of the neurotransmitter dopamine in brain circuits regulating pleasure and movement.

Chewing khat leaves is reported to induce a state of euphoria and elation as well as feelings of increased alertness and arousal. The effects begin to subside after about 90 minutes to 3 hours, but can last 24 hours. At the end of a khat session, the user may experience a depressed mood, irritability, loss of appetite, and difficulty sleeping.

### What Are the Other Health Effects of Khat?

In addition to its psychological effects, khat users can also experience physiological effects typically produced by stimulants, including an increase in blood pressure and heart rate.

There are a number of adverse physical effects that have been associated with heavy or long-term use of khat, including tooth decay and periodontal disease; gastrointestinal disorders such as con-



### Who Uses Khat?

It is estimated that as many as 10 million people worldwide chew khat. It is commonly found in the southwestern part of the Arabian Peninsula and in East Africa, where it has been used for centuries as part of an established cultural tradition. In one large study in Yemen, 82 percent of men and 43 percent of women reported at least one lifetime episode of khat use. Its current use among particular migrant communities in the United States and in Europe has caused concern among policymakers and health care professionals. No reliable estimates of prevalence in the United States exist.

stipation, ulcers, inflammation of the stomach, and increased risk of upper gastrointestinal tumors; and cardiovascular disorders such as irregular heart-

beat, decreased blood flow, and heart attack.

There is also consistent epidemiologic evidence for a weak association between chronic khat use and mental disorders. Although there is no evidence that khat use causes mental illness, chewing khat leaves may worsen symptoms in patients who have pre-existing psychiatric conditions.

It is unclear whether khat causes tolerance, physical dependency, addiction, or withdrawal, but long-term users have reported mild depression, nightmares, and trembling after ceasing to chew khat.

### Learn More

For additional information on Khat, please see [http://www.justice.gov/dea/druginfo/drug\\_data\\_sheets/Khat.pdf](http://www.justice.gov/dea/druginfo/drug_data_sheets/Khat.pdf)

# Drug Facts

[www.drugabuse.gov](http://www.drugabuse.gov)

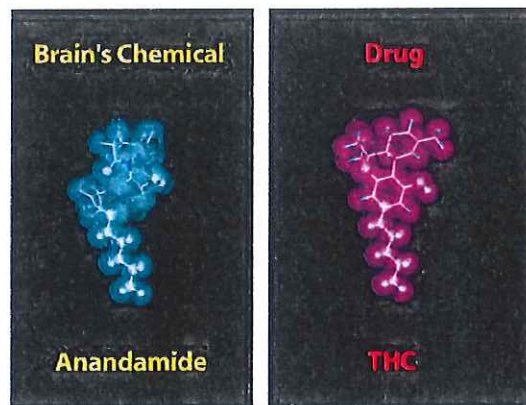
## Marijuana

Marijuana is a dry, shredded green and brown mix of leaves, flowers, stems, and seeds from the hemp plant *Cannabis sativa*. In a more concentrated, resinous form, it is called hashish, and as a sticky black liquid, hash oil. The main psychoactive (mind-altering) chemical in marijuana is delta-9-tetrahydrocannabinol, or THC.

Marijuana is the most common illicit drug used in the United States. After a period of decline in the last decade, its use has generally increased among young people since 2007, corresponding to a diminishing perception of the drug's risks. More teenagers are now current (past-month) smokers of marijuana than of cigarettes, according to annual survey data.

### How Is Marijuana Used?

Marijuana is usually smoked in hand-rolled cigarettes (joints) or in pipes or water pipes (bongs). It is also smoked in blunts—cigars that have been emptied of tobacco and refilled with a mixture of marijuana and tobacco. Marijuana smoke has a pungent and distinctive, usually sweet-and-sour, odor. Marijuana can also be mixed in food or brewed as a tea.



### How Does Marijuana Affect the Brain?

When marijuana is smoked, THC rapidly passes from the lungs into the bloodstream, which carries the chemical to the brain and other organs throughout the body. It is absorbed more slowly when ingested in food or drink.

However it is ingested, THC acts upon specific molecular targets on brain cells, called cannabinoid receptors. These receptors are ordinarily activated by chemicals similar to THC called endocannabinoids, such as anandamide. These are naturally occurring in the body and are part of a neural communication network (the endocannabinoid system) that plays an important role in normal brain development and function.

The highest density of cannabinoid receptors is found in parts of the brain that

influence pleasure, memory, thinking, concentration, sensory and time perception, and coordinated movement. Marijuana overactivates the endocannabinoid system, causing the high and other effects that users experience. These include distorted perceptions, impaired coordination, difficulty with thinking and problem solving, and disrupted learning and memory.

### Effects on Life

Research clearly demonstrates that marijuana has the potential to cause problems in daily life or make a person's existing problems worse. In fact, heavy marijuana users generally report lower life satisfaction, poorer mental and physical health, relationship problems, and less academic and career success compared to their peers who came from similar backgrounds. For example, marijuana use is associated with a higher likelihood of dropping out from school. Several studies also associate workers' marijuana smoking with increased absences, tardiness, accidents, workers' compensation claims, and job turnover.

Research has shown that, in chronic users, marijuana's adverse impact on learning and memory persists after the acute effects of the drug wear off; when marijuana use begins in adolescence, the effects may persist for many years. Research from different areas is converging on the fact that regular marijuana use by young people can have long-lasting negative impact on the structure and function of their brains.

A recent study of marijuana users who began using in adolescence revealed a profound deficit in connections between brain areas responsible for learning and memory. And a large prospective study (following individuals across time) showed that people who began smoking

marijuana heavily in their teens lost as much as 8 points in IQ between age 13 and age 38; importantly, the lost cognitive abilities were not restored in those who quit smoking marijuana as adults. (Individuals who started smoking marijuana in adulthood did not show significant IQ declines.)

### What Are the Other Health Effects of Marijuana?

Marijuana use can have a variety of adverse, short- and long-term effects, especially on cardiopulmonary and mental health.

Marijuana raises heart rate by 20-100 percent shortly after smoking; this effect can last up to 3 hours. In one study, it was estimated that marijuana users have a 4.8-fold increase in the risk of heart attack in the first hour after smoking the drug. This may be due to increased heart rate as well as the effects of marijuana on heart rhythms, causing palpitations and arrhythmias. This risk may be greater in older individuals or in those with cardiac vulnerabilities.

### Marijuana and Driving

Because it seriously impairs judgment and motor coordination, marijuana also contributes to accidents while driving. A recent analysis of data from several studies found that marijuana use more than doubles a driver's risk of being in an accident. Further, the combination of marijuana and alcohol is worse than either substance alone with respect to driving impairment.

Marijuana smoke is an irritant to the lungs, and frequent marijuana smokers can have many of the same respiratory problems experienced by tobacco smokers, such as daily cough and phlegm production, more frequent acute chest ill-

ness, and a heightened risk of lung infections. One study found that people who smoke marijuana frequently but do not smoke tobacco have more health problems and miss more days of work than

### Is Marijuana Medicine?

Although many have called for the legalization of marijuana to treat conditions including pain and nausea caused by HIV/AIDS, cancer, and other conditions, the scientific evidence to date is not sufficient for the marijuana plant to gain FDA approval, for two main reasons.

First, there have not been enough clinical trials showing that marijuana's benefits outweigh its health risks in patients with the symptoms it is meant to treat. The FDA requires carefully conducted studies in large numbers of patients (hundreds to thousands) to accurately assess the benefits and risks of a potential medication.

Also, to be considered a legitimate medicine, a substance must have well-defined and measurable ingredients that are consistent from one unit (such as a pill or injection) to the next. This consistency allows doctors to determine the dose and frequency. As the marijuana plant contains hundreds of chemical compounds that may have different effects and that vary from plant to plant, its use as a medicine is difficult to evaluate.

However, THC-based drugs to treat pain and nausea are already FDA approved and prescribed, and scientists continue to investigate the medicinal properties of cannabinoids. For more information, see

<http://www.drugabuse.gov/publications/drugfacts/marijuana-medicine>

nonsmokers, mainly because of respiratory illnesses.

A number of studies have shown an association between chronic marijuana use and mental illness. High doses of marijuana can produce a temporary psychotic reaction (involving hallucinations and paranoia) in some users, and using marijuana can worsen the course of illness in patients with schizophrenia. A series of large prospective studies also showed a link between marijuana use and later development of psychosis. This relationship was influenced by genetic variables as well as the amount of drug used and the age at which it was first taken—those who start young are at increased risk for later problems.

Associations have also been found between marijuana use and other mental health problems, such as depression, anxiety, suicidal thoughts among adolescents, and personality disturbances, including a lack of motivation to engage in typically rewarding activities. More research is still needed to confirm and better understand these linkages.

Marijuana use during pregnancy is associated with increased risk of neurobehavioral problems in babies. Because THC and other compounds in marijuana mimic the body's own cannabinoid-like chemicals, marijuana use by pregnant mothers may alter the developing endocannabinoid system in the brain of the fetus. Consequences for the child may include problems with attention, memory, and problem solving.

Finally, marijuana use has been linked in a few recent studies to an increased risk of an aggressive type of testicular cancer in young men, although further research is needed to establish whether there is a direct causal connection.

### Is Marijuana Addictive?

Contrary to common belief, marijuana is addictive. Estimates from research suggest that about 9 percent of users become addicted to marijuana; this number increases among those who start young (to about 17 percent, or 1 in 6) and among daily users (to 25-50 percent). Thus, many of the nearly 7 percent of high-school seniors who (according to annual survey data) report smoking marijuana daily or almost daily are well on their way to addiction, if not already addicted (besides functioning at a sub-optimal level all of the time).

Long-term marijuana users trying to quit report withdrawal symptoms including irritability, sleeplessness, decreased appetite, anxiety, and drug craving, all of which can make it difficult to remain ab-

### **Rising Potency**

The amount of THC in marijuana samples confiscated by police has been increasing steadily over the past few decades. In 2009, THC concentrations in marijuana averaged close to 10 percent, compared to around 4 percent in the 1980s. For a new user, this may mean exposure to higher concentrations of THC, with a greater chance of an adverse or unpredictable reaction. Increases in potency may account for the rise in emergency department visits involving marijuana use. For experienced users, it may mean a greater risk for addiction if they are exposing themselves to high doses on a regular basis. However, the full range of consequences associated with marijuana's higher potency is not well understood, nor is it known whether experienced marijuana users adjust for the increase in potency by using less.

stinent. Behavioral interventions, including cognitive-behavioral therapy and motivational incentives (i.e., providing vouchers for goods or services to patients who remain abstinent) have proven to be effective in treating marijuana addiction. Although no medications are currently available, recent discoveries about the workings of the endocannabinoid system offer promise for the development of medications to ease withdrawal, block the intoxicating effects of marijuana, and prevent relapse.

### **Learn More**

For additional information on marijuana and marijuana abuse, please see <http://www.drugabuse.gov/publications/research-reports/marijuana-abuse>

# INFOFACTS

www.drugabuse.gov

National Institute on Drug Abuse • National Institutes of Health • U.S. Department of Health & Human Services

## Methamphetamine

Methamphetamine is a central nervous system stimulant drug that is similar in structure to amphetamine. Due to its high potential for abuse, methamphetamine is classified as a Schedule II drug and is available only through a prescription that cannot be refilled. Although methamphetamine can be prescribed by a doctor, its medical uses are limited, and the doses that are prescribed are much lower than those typically abused. Most of the methamphetamine abused in this country comes from foreign or domestic superlabs, although it can also be made in small, illegal laboratories, where its production endangers the people in the labs, neighbors, and the environment.

### How Is Methamphetamine Abused?

Methamphetamine is a white, odorless, bitter-tasting crystalline powder that easily dissolves in water or alcohol and is taken orally, intranasally (snorting the powder), by needle injection, or by smoking.

### How Does Methamphetamine Affect the Brain?

Methamphetamine increases the release and blocks the reuptake of the brain chemical (or neurotransmitter) dopamine, leading to high levels of the chemical in the brain—a common mechanism of action for most drugs of abuse. Dopamine is involved in reward, motivation, the experience of pleasure, and motor function. Methamphetamine's ability to release dopamine rapidly in reward regions of the brain produces the intense euphoria, or "rush," that many users feel after snorting, smoking, or injecting the drug.

Chronic methamphetamine abuse significantly changes how the brain functions. Noninvasive human brain imaging studies have shown alterations in the activity of the dopamine system that are associated with reduced motor skills and impaired verbal learning.<sup>1</sup> Recent studies in chronic methamphetamine abusers have also revealed severe structural and functional changes in areas of the brain associated with emotion and memory,<sup>2,3</sup> which may account for many of the emotional and cognitive problems observed in chronic methamphetamine abusers.

Repeated methamphetamine abuse can also lead to addiction—a chronic, relapsing disease characterized by compulsive drug seeking and use, which is accompanied by chemical and molecular changes in the brain. Some of these changes persist long after methamphetamine abuse is stopped. Reversal of some of the changes, however, may be observed after sustained periods of abstinence (e.g., more than 1 year).<sup>4</sup>

## **What Other Adverse Effects Does Methamphetamine Have on Health?**

Taking even small amounts of methamphetamine can result in many of the same physical effects as those of other stimulants, such as cocaine or amphetamines, including increased wakefulness, increased physical activity, decreased appetite, increased respiration, rapid heart rate, irregular heartbeat, increased blood pressure, and hyperthermia.

Long-term methamphetamine abuse has many negative health consequences, including extreme weight loss, severe dental problems (“meth mouth”), anxiety, confusion, insomnia, mood disturbances, and violent behavior. Chronic methamphetamine abusers can also

display a number of psychotic features, including paranoia, visual and auditory hallucinations, and delusions (for example, the sensation of insects crawling under the skin).

Transmission of HIV and hepatitis B and C can be consequences of methamphetamine abuse. The intoxicating effects of methamphetamine, regardless of how it is taken, can also alter judgment and inhibition and can lead people to engage in unsafe behaviors, including risky sexual behavior. Among abusers who inject the drug, HIV/AIDS and other infectious diseases can be spread through contaminated needles, syringes, and other injection equipment that is used by more than one person. Methamphetamine abuse may also worsen the progression of HIV/AIDS and its consequences. Studies of methamphetamine abusers who are HIV-positive indicate that HIV causes greater neuronal injury and cognitive impairment for individuals in this group compared with HIV-positive people who do not use the drug.<sup>5,6</sup>

## **What Treatment Options Exist?**

Currently, the most effective treatments for methamphetamine addiction are comprehensive cognitive-behavioral interventions. For example, the Matrix

Model—a behavioral treatment approach that combines behavioral therapy, family education, individual counseling, 12-step support, drug testing, and encouragement for nondrug-related activities—has been shown to be effective in reducing methamphetamine abuse.<sup>7</sup> Contingency management interventions, which provide tangible incentives in exchange for engaging in treatment and maintaining abstinence, have also been shown to be effective.<sup>8</sup> There are no medications at this time approved to treat methamphetamine addiction; however, this is an active area of research for NIDA.

## How Widespread Is Methamphetamine Abuse?

### *Monitoring the Future Survey*<sup>†</sup>

Methamphetamine use among teens appears to have dropped significantly in recent years, according to data revealed by the 2009 Monitoring the Future survey. The number of high-school seniors reporting past-year<sup>††</sup> use is now only at 1.2 percent, which is the lowest since questions about methamphetamine were added to the survey in 1999; at that time, it was reported at 4.7 percent. Lifetime use among 8th-graders was reported at 1.6 percent in 2009, down significantly from 2.3 percent in 2008. In addition, the proportion of 10th-graders

reporting that crystal methamphetamine was easy to obtain has dropped to 14 percent, down from 19.5 percent 5 years ago.

### **Use of Methamphetamine by Students 2009 Monitoring the Future Survey**

	8th Grade	10th Grade	12th Grade
Lifetime	1.6%	2.8%	2.4%
Past Year	1.0%	1.6%	1.2%
Past Month	0.5%	0.6%	0.5%

### **National Survey on Drug Use and Health (NSDUH)<sup>†††</sup>**

According to the 2008 National Survey on Drug Use and Health, the number of past-month methamphetamine users age 12 and older decreased by over half between 2006 and 2008. Current (past-month) users were numbered at 731,000 in 2006, 529,000 in 2007, and 314,000 in 2008. Significant declines from 2002 and 2008 also were noted for lifetime and past-year use in this age group.

From 2002 to 2008, past-month use of methamphetamine declined significantly among youths aged 12 to 17, from 0.3 percent to 0.1 percent, and young adults aged 18 to 25 also reported significant declines in past-month use, from 0.6 percent in 2002 to 0.2 percent in 2008.



## Other Information Sources

For more information on the effects of methamphetamine abuse and addiction, visit [www.drugabuse.gov/drugpages/methamphetamine.html](http://www.drugabuse.gov/drugpages/methamphetamine.html).

To find publicly funded treatment facilities by state, visit [www.findtreatment.samhsa.gov](http://www.findtreatment.samhsa.gov).

For street terms searchable by drug name, cost and quantities, drug trade, and drug use, visit [www.whitehousedrugpolicy.gov/streetterms/default.asp](http://www.whitehousedrugpolicy.gov/streetterms/default.asp).

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### Data Sources

<sup>†</sup> These data are from the 2009 Monitoring the Future survey, funded by the National Institute on Drug Abuse, National Institutes of Health, Department of Health and Human Services, and conducted annually by the University of Michigan's Institute for Social Research. The survey has tracked 12th-graders' illicit drug use and related attitudes since 1975; in 1991, 8th- and 10th-graders were added to the study. Questions about crystal methamphetamine were added to the 12th-grade and followup surveys in 1990, and questions about methamphetamine were added to the study for all three grades in 1999. The latest data are on line at [www.drugabuse.gov](http://www.drugabuse.gov).

<sup>††</sup> "Lifetime" refers to use at least once during a respondent's lifetime. "Past year" refers to use at least once during the year preceding an individual's response to the survey. "Past month" refers to use at least once during the 30 days preceding an individual's response to the survey.

<sup>†††</sup> NSDUH (formerly known as the National Household Survey on Drug Abuse) is an annual survey of Americans aged 12 and older conducted by the Substance Abuse and Mental Health Services Administration, Department of Health and Human Services. This survey is available on line at [www.samhsa.gov](http://www.samhsa.gov) and can be ordered by phone from NIDA at 877-643-2644.

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# Drug Facts

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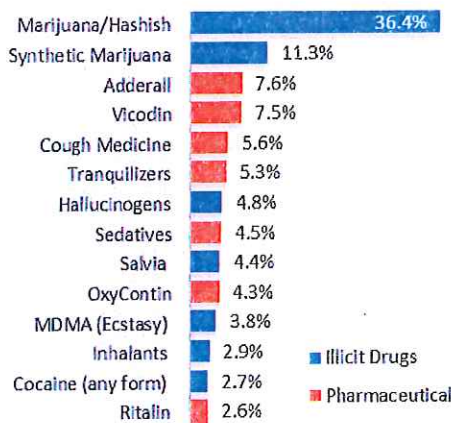
## Prescription and Over-the-Counter Medications

Some medications have psychoactive (mind-altering) properties and, because of that, are sometimes abused—that is, taken for reasons or in ways or amounts not intended by a doctor, or taken by someone other than the person for whom they are prescribed. In fact, prescription and over-the-counter (OTC) drugs are, after marijuana (and alcohol), the most commonly abused substances by Americans 14 and older.

stimulants for treating Attention Deficit Hyperactivity Disorder (ADHD), such as Adderall, Concerta, or Ritalin; and central nervous system (CNS) depressants for relieving anxiety, such as Valium or Xanax.<sup>1</sup> The most commonly abused OTC drugs are cough and cold remedies containing dextromethorphan.

People often think that prescription and OTC drugs are safer than illicit drugs, but that's only true when they are taken exactly as prescribed and for the purpose intended. When abused, prescription and OTC drugs can be addictive and put abusers at risk for other adverse health effects, including overdose—especially when taken along with other drugs or alcohol.

Past-Year Use of Illicit Drugs and Pharmaceuticals among 12th Graders



SOURCE: University of Michigan, 2012 Monitoring the Future Study

### How Are Prescription Drugs Abused?

Prescription and OTC drugs may be abused in one or more of the following ways:

*Taking a medication that has been prescribed for somebody else.* Unaware of the dangers of sharing medications, people often unknowingly contribute to this

The classes of prescription drugs most commonly abused are: opioid pain relievers, such as Vicodin or Oxycontin;

<sup>1</sup> These are proprietary names of particular drug products. Generic versions may also exist.

form of abuse by sharing their unused pain relievers with their family members.

**Most teenagers who abuse prescription drugs are given them for free by a friend or relative.**

*Taking a drug in a higher quantity or in another manner than prescribed.* Most prescription drugs are dispensed orally in tablets, but abusers sometimes crush the tablets and snort or inject the powder. This hastens the entry of the drug into the bloodstream and the brain and amplifies its effects.



*Taking a drug for another purpose than prescribed.* All of the drug types mentioned can produce pleasurable effects at sufficient quantities, so taking them for the purpose of getting high is one of the main reasons people abuse them.

ADHD drugs like Adderall are also often abused by students seeking to improve their academic performance. However, although they may boost alertness, there is little evidence they improve cognitive functioning for those without a medical condition.

### **How Do Prescription and OTC Drugs Affect the Brain?**

Taken as intended, prescription and OTC drugs safely treat specific mental or physical symptoms. But when taken in different quantities or when such symp-

toms aren't present, they may affect the brain in ways very similar to illicit drugs.

For example, stimulants such as Ritalin achieve their effects by acting on the same neurotransmitter systems as cocaine. Opioid pain relievers such as OxyContin attach to the same cell receptors targeted by illegal opioids like heroin. Prescription depressants produce sedating or calming effects in the same manner as the club drugs GHB and rohypnol. And when taken in very high doses, dextromethorphan acts on the same cell receptors as PCP or ketamine, producing similar out-of-body experiences.

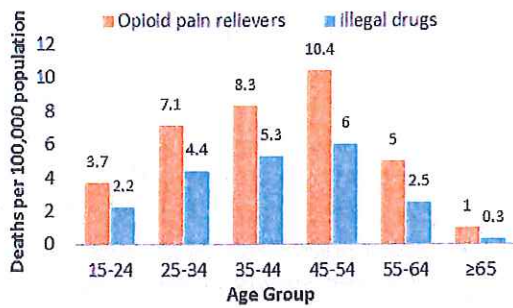
When abused, all of these classes of drugs directly or indirectly cause a pleasurable increase in the amount of dopamine in the brain's reward pathway. Repeatedly seeking to experience that feeling can lead to addiction.

### **What Are the Other Health Effects of Prescription and OTC Drugs?**

Stimulants can have strong effects on the cardiovascular system. Taking high doses of a stimulant can dangerously raise body temperature and cause irregular heartbeat or even heart failure or seizures. Also, taking some stimulants in high doses or repeatedly can lead to hostility or feelings of paranoia.

Opioids can produce drowsiness, cause constipation, and—depending upon the amount taken—depress breathing. The latter effect makes opioids particularly dangerous, especially when they are snorted or injected or combined with other drugs or alcohol. More people die from overdoses of prescription opioids than from all other drugs combined, including heroin and cocaine (see graph below).

### Deaths from Opioid Pain Relievers Exceed Those from All Illegal Drugs



Source: CDC, Morbidity and Mortality Weekly Report, 60(43):1489, 2011.

CNS depressants slow down brain activity and can cause sleepiness and loss of coordination. Continued use can lead to physical dependence and withdrawal symptoms if discontinuing use.

Dextromethorphan can cause impaired motor function, numbness, nausea or vomiting, and increased heart rate and blood pressure. On rare occasions, hypoxic brain damage—caused by severe respiratory depression and a lack of oxygen to the brain—has occurred due to the combination of dextromethorphan with decongestants often found in the medication.

All of these drugs have the potential for addiction, and this risk is amplified when they are abused. Also, as with other drugs, abuse of prescription and OTC drugs can alter a person's judgment and decision making, leading to dangerous behaviors such as unsafe sex and drugged driving.

### Prescription Opioid Abuse: A First Step to Heroin Use?

Prescription opioid pain medications such as Oxycontin and Vicodin can have effects similar to heroin when taken in doses or in ways other than prescribed, and research now suggests that abuse of these drugs may actually open the door to heroin abuse.

Nearly half of young people who inject heroin surveyed in three recent studies reported abusing prescription opioids before starting to use heroin. Some individuals reported taking up heroin because it is cheaper and easier to obtain than prescription opioids.

Many of these young people also report that crushing prescription opioid pills to snort or inject the powder provided their initiation into these methods of drug administration.

### Learn More

For more information on prescription and OTC drugs, visit <http://www.drugabuse.gov/publications/research-reports/prescription-drugs>

# Drug Facts

www.drugabuse.gov

## Spice (Synthetic Marijuana)

“Spice” refers to a wide variety of herbal mixtures that produce experiences similar to marijuana (cannabis) and that are marketed as “safe,” legal alternatives to that drug. Sold under many names, including K2, fake weed, Yucatan Fire, Skunk, Moon Rocks, and others—and labeled “not for human consumption”—these products contain dried, shredded plant material and chemical additives that are responsible for their psychoactive (mind-altering) effects.

### False Advertising

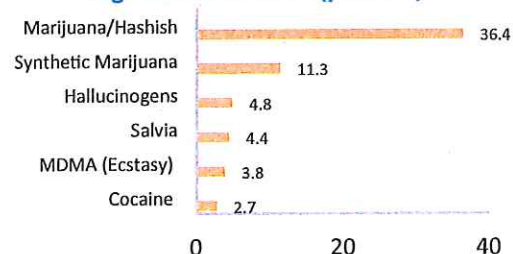
Labels on Spice products often claim that they contain “natural” psychoactive material taken from a variety of plants. Spice products do contain dried plant material, but chemical analyses show that their active ingredients are *synthetic* (or designer) cannabinoid compounds.

For several years, Spice mixtures have been easy to purchase in head shops and gas stations and via the Internet. Because the chemicals used in Spice have a high potential for abuse and no medical benefit, the Drug Enforcement Administration (DEA) has designated the five active chemicals most frequently

found in Spice as Schedule I controlled substances, making it illegal to sell, buy, or possess them. Manufacturers of Spice products attempt to evade these legal restrictions by substituting different chemicals in their mixtures, while the DEA continues to monitor the situation and evaluate the need for updating the list of banned cannabinoids.

Spice products are popular among young people; of the illicit drugs most used by high-school seniors, they are second only to marijuana. (They are more popular among boys than girls—in 2012, nearly twice as many male 12<sup>th</sup> graders reported past-year use of synthetic marijuana as females in the same age group.) Easy access and the misperception that Spice products are “natural” and therefore harmless have likely contributed to their popularity. Another selling point is that the chemicals used in Spice are not easily detected in standard drug tests.

Past-Year Use of Illicit Drugs by High School Seniors (percent)



SOURCE: University of Michigan, 2012 Monitoring the Future Study

## How Is Spice Abused?

Some Spice products are sold as “incense,” but they more closely resemble potpourri. Like marijuana, Spice is abused mainly by smoking. Sometimes Spice is mixed with marijuana or is prepared as an herbal infusion for drinking.



## How Does Spice Affect the Brain?

Spice users report experiences similar to those produced by marijuana—elevated mood, relaxation, and altered perception—and in some cases the effects are even stronger than those of marijuana. Some users report psychotic effects like extreme anxiety, paranoia, and hallucinations.

So far, there have been no scientific studies of Spice’s effects on the human brain, but we do know that the cannabinoid compounds found in Spice products act on the same cell receptors as THC, the primary psychoactive component of marijuana. Some of the compounds found in

Spice, however, bind more strongly to those receptors, which could lead to a much more powerful and unpredictable effect. Because the chemical composition of many products sold as Spice is unknown, it is likely that some varieties also contain substances that could cause dramatically different effects than the user might expect.

## What Are the Other Health Effects of Spice?

Spice abusers who have been taken to Poison Control Centers report symptoms that include rapid heart rate, vomiting, agitation, confusion, and hallucinations. Spice can also raise blood pressure and cause reduced blood supply to the heart (myocardial ischemia), and in a few cases it has been associated with heart attacks. Regular users may experience withdrawal and addiction symptoms.

We still do not know all the ways Spice may affect human health or how toxic it may be, but one public health concern is that there may be harmful heavy metal residues in Spice mixtures. Without further analyses, it is difficult to determine whether this concern is justified.

## Learn More

For additional information on Spice, see [http://www.emcdda.europa.eu/attachements.cfm/att\\_80086\\_EN\\_Spice%20The%20paper%20—%20final%20version.pdf](http://www.emcdda.europa.eu/attachements.cfm/att_80086_EN_Spice%20The%20paper%20—%20final%20version.pdf)

# Drug Facts

[www.drugabuse.gov](http://www.drugabuse.gov)

## Salvia

Salvia (*Salvia divinorum*) is an herb in the mint family native to southern Mexico. It is used to produce hallucinogenic experiences.



### How Is Salvia Used?

Traditionally, *S. divinorum* has been ingested by chewing fresh leaves or by drinking their extracted juices. The dried leaves of *S. divinorum* can also be smoked in rolled cigarettes or pipes or vaporized and inhaled.

Although information about salvia is limited, its use may be driven in part by drug-related videos and information on Internet sites. Because of the nature of the drug's effects—brief hallucinogenic experiences that mimic psychosis—it is more likely to be used in individual experimentation than as a social or party drug.

### How Does Salvia Affect the Brain?

The main active ingredient in salvia, salvinorin A, is a potent activator of nerve cell targets called kappa opioid receptors. (These receptors differ from the receptors activated by commonly known opioid drugs such as heroin and morphine.) Although salvia is generally considered a hallucinogen, it does not act at serotonin receptors that are activated by other hallucinogens like LSD or psilocybin, and its effects are reported by experienced users to be different from those drugs.

Subjective effects of salvia use have been described as intense but short-lived, appearing in less than 1 minute and lasting less than 30 minutes. They include psychedelic-like changes in visual perception, mood and body sensations, emotional swings, feelings of detachment, and a highly modified perception of external reality and the self, leading to a decreased ability to interact with one's surroundings. This last effect has prompted concern about the dangers of driving under the influence of salvinorin.

### What Are the Other Health Effects of Salvia?

The psychological or physical health effects of salvia use have not been investi-

gated systematically, and consequences of long-term use are not known. Experiments in rodents demonstrated deleterious effects of salvinorin A on learning and memory, but there is little evidence of salvia causing dependence or long-term psychiatric problems in humans.

### **Is Salvia Illegal?**

Salvia currently is not a drug regulated by the Controlled Substances Act, but several States and countries have passed legislation to regulate its use.

### **Learn More**

For additional information on salvia, please see [http://www.deadiversion.usdoj.gov/drog\\_chem\\_info/salvia\\_d.pdf](http://www.deadiversion.usdoj.gov/drog_chem_info/salvia_d.pdf)

For more information on the effects of hallucinogenic drugs, see NIDA's [\*Research Report on Hallucinogens and Dissociative Drugs\*](#).



## Smokeless Tobacco – December 2009

### A Research Update from the National Institute on Drug Abuse

**What is Smokeless Tobacco?** There are two types—snuff and chewing tobacco. **Snuff**, a finely ground or shredded tobacco, is packaged dry, moist, or in porous tea bag–like pouches. Typically, the user places a pinch or dip between the cheek and gum.

**Chewing tobacco** is available in loose leaf, plug, or twist forms, with the user putting a wad of tobacco inside the cheek. Smokeless tobacco is sometimes called "spit" or "spitting" tobacco because people spit out the juices and saliva that build up in the mouth\*.



**Is Smokeless Tobacco Addictive?** Yes, all tobacco, including smokeless tobacco, contains nicotine, which is addictive. The amount of nicotine absorbed from smokeless tobacco is 3-4 times that delivered by a cigarette, and while nicotine is absorbed more slowly from smokeless tobacco, more nicotine per dose is absorbed and stays in the bloodstream for longer. Furthermore, when a smokeless tobacco user tries to quit, they can experience an array of withdrawal symptoms, including craving, irritability and depressed mood, which can cause them to resume their use\*.

### Who Uses Smokeless Tobacco Products?

Americans spent \$2.6 billion dollars on smokeless tobacco products in 2005 compared to \$82 billion on cigarettes, and while cigarette sales are recently declining, smokeless tobacco sales continue to grow, tripling between 1986-2005<sup>i, ii</sup>.

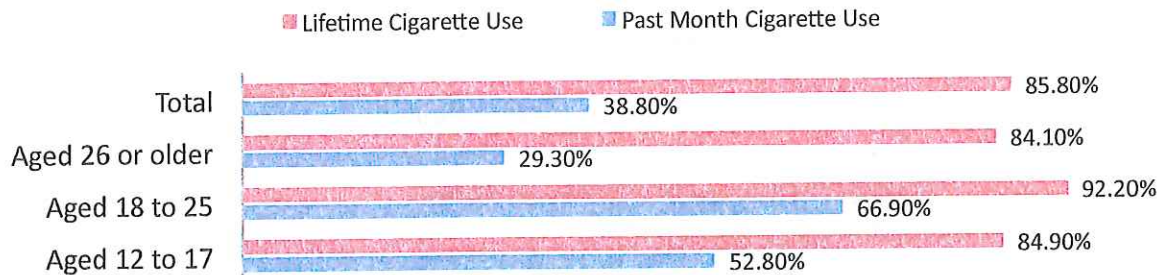
- 8.7 million Americans (3.5% of the population) aged 12 and older were **current (past month) users** of smokeless tobacco products in 2008, **most commonly young adults ages 18 to 25**.<sup>iii</sup>
- Men are more than 10 times more likely than women to report using smokeless tobacco in the past month: 6.8% of men age 12 and older compared to 0.4% of women.<sup>iii</sup>
- While there have been declines **in cigarette smoking among teens** since the mid-1990s, the **use of smokeless tobacco** has been mostly unchanged for the past five years, with increases seen among 10<sup>th</sup> graders between 2008 and 2009.<sup>iv</sup>
- 13.4% of high school boys (and 2.3% of girls) **are current users of smokeless products**; among high school seniors who ever used smokeless tobacco products, almost 75% began by the 9<sup>th</sup> grade.<sup>v</sup>
- There was a **47% increase in the number of new smokeless tobacco users** between 2002-2008.<sup>v</sup>
  - 73% of the 1.4 million new smokeless tobacco users in 2008 were male, and a little more than half (52.5 percent) were under age 18 when they first used.<sup>v</sup>

### What is the Relationship between Smokeless Tobacco and cigarette use?

- Overall, 85.8% of past month smokeless tobacco users also smoked cigarettes at some time in their lives; 38.8% used cigarettes in the past month.<sup>vi</sup>

- 31.8% of those using both smokeless tobacco and cigarettes in their lifetime began using smokeless tobacco first; 65.5% used cigarettes first and 2.7% initiated use of both products at the same time.<sup>vi</sup>

Percentage of Cigarette Use among Past Month Smokeless Tobacco Users, by age: 2002-2007. Source: SAMHSA, 2002 to 2007 NSDUH.



### Why is Smokeless Tobacco Bad for your Health\*?

- Chewing tobacco and snuff contain 28 carcinogens (cancer-causing agents).
- Smokeless tobacco increases the risk for cancer of the oral cavity, which can include cancer of the lip, tongue, cheeks, gums, and the floor and roof of the mouth.
- Other effects include oral leukoplakia (white mouth lesions that can become cancerous), gum disease, and gum recession (when the gum pulls away from the teeth).
- Possible increased risks for heart disease, diabetes, and reproductive problems are being studied.

### Can smokeless tobacco products be used to quit smoking cigarettes?

No. All tobacco use causes disease and addiction and thus should be avoided or discontinued. An average of 400,000 Americans switch from cigarettes to smokeless tobacco products each year, many in an effort to quit smoking. However, almost 90% of daily smokers who initiated smokeless tobacco use as a means to quit smoking were still smoking daily 6 months later.<sup>vi</sup>

### How to Quit

There are several effective smoking cessation treatments, including pharmacotherapies such as nicotine replacement therapy (including nicotine gum, patches or lozenges), bupropion SR (Zyban), Varenicline (Chantix), as well as individual and group counseling, which may also prove useful for people trying to quit smokeless tobacco. In addition, the U.S. Department of Health and Human Services has established a national telephone quit-line, 1-800-QUIT-NOW (1-800-784-8669), to assist users of tobacco seeking information and assistance in quitting and a new website ([www.smokefree.gov](http://www.smokefree.gov)) which offers online advice and downloadable information to make cessation easier.

\* Adapted from National Cancer Institute. *Smokeless Tobacco and Cancer: Questions and Answers*. U.S. DHHS, NIH. Available on line: <http://www.cancer.gov/cancertopics/factsheet/Tobacco/smokeless>

<sup>i</sup> U.S. Federal Trade Commission (FTC), *Smokeless Tobacco Report for the Year 2006*. Available on line: <http://www2.ftc.gov/os/2009/08/090812smokelesstobaccoreport.pdf>

<sup>ii</sup> U.S. Department of Agriculture, *Expenditures for Tobacco Products and Disposable Personal Income, 1989-2006*, compiled from reports of the Department of Commerce, Bureau of Economic Analysis.

<sup>iii</sup> SAMHSA. *2008 National Survey on Drug Use and Health: National Findings*. DHHS NSDUH, Office of Applied Studies. Available on line: <http://www.oas.samhsa.gov/nsduh/2k8nsduh/2k8Results.pdf>

<sup>iv</sup> *Monitoring the Future National Results on Adolescent Drug Use: Overview of Key Findings, 2009*. Ann Arbor, MI: The University of Michigan. Available on line: <http://www.monitoringthefuture.org>

<sup>v</sup> Centers for Disease Control and Prevention, *Youth Risk Behavior Surveillance United States, 2007*. MMWR 2007; 57(SS-4):1-136

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<sup>vi</sup> SAMHSA, Office of Applied Statistics. The NSDUH Report: *Smokeless tobacco Use, Initiation and Relationship to Cigarette Smoking: 2002 to 2007*. Available on line: <http://www.oas.samhsa.gov/2k9/smokelessTobacco/smokelessTobacco.htm>

**For further information please visit NIDA on the web at [www.drugabuse.gov](http://www.drugabuse.gov) or contact:**

Public Information and Liaison Branch Office of Science Policy and Communications Phone 301-443-1124/Fax 301-443-7397  
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