

Marijuana

Marijuana is the most commonly abused illicit drug in the United States. A dry, shredded green/brown mix of flowers, stems, seeds, and leaves of the hemp plant *Cannabis sativa*, it usually is smoked as a cigarette (joint, nail), or in a pipe (bong). It also is smoked in blunts, which are cigars that have been emptied of tobacco and refilled with marijuana, often in combination with another drug. It might also be mixed in food or brewed as a tea. As a more concentrated, resinous form it is called hashish and, as a sticky black liquid, hash oil. Marijuana smoke has a pungent and distinctive, usually sweet-and-sour odor. There are countless street terms for marijuana including pot, herb, weed, grass, widow, ganja, and hash, as well as terms derived from trademarked varieties of cannabis, such as Bubble Gum, Northern Lights, Fruity Juice, Afghani #1, and a number of Skunk varieties.

The main active chemical in marijuana is THC (delta-9-tetrahydrocannabinol). The membranes of certain nerve cells in the brain contain protein receptors that bind to THC. Once securely in place, THC kicks off a series of cellular reactions that ultimately lead to the high that users experience when they smoke marijuana.

Extent of Use ———

In 2004, 14.6 million Americans age 12 and older used marijuana at least once in the month prior to being surveyed. About 6,000 people a day in 2004 used marijuana for the first time—2.1 million Americans. Of these, 63.8 percent were under age 18⁽¹⁾. In the last half of 2003, marijuana was the third most commonly abused drug mentioned in drug-related hospital emergency department (ED) visits in the continental United States, at 12.6 percent, following cocaine (20 percent) and alcohol (48.7 percent)⁽²⁾.

**Percentage of 8th-Graders Who Have Used Marijuana
Monitoring the Future Survey, 2005**

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Lifetime	23.1%	22.6%	22.2%	22.0%	20.3%	20.4%	19.2%	17.5%	16.3%	16.5%
Annual	18.3	17.7	16.9	16.5	15.6	15.4	14.6	12.8	11.8	12.2
30-day	11.3	10.2	9.7	9.7	9.1	9.2	8.3	7.5	6.4	6.6
Daily	1.5	1.1	1.1	1.4	1.3	1.3	1.2	1.0	0.8	1.0

**Percentage of 10th-Graders Who Have Used Marijuana
Monitoring the Future Survey, 2005**

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Lifetime	39.8%	42.3%	39.6%	40.9%	40.3%	40.1%	38.7%	36.4%	35.1%	34.1%
Annual	33.6	34.8	31.1	32.1	32.2	32.7	30.3	28.2	27.5	26.6
30-day	20.4	20.5	18.7	19.4	19.7	19.8	17.8	17.0	15.9	15.2
Daily	3.5	3.7	3.6	3.8	3.8	4.5	3.9	3.6	3.2	3.1

**Percentage of 12th-Graders Who Have Used Marijuana
Monitoring the Future Survey, 2005**

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Lifetime	44.9%	49.6%	49.1%	49.7%	48.8%	49.0%	47.8%	46.1%	45.7%	44.8%
Annual	35.8	38.5	37.5	37.8	36.5	37.0	36.2	34.9	34.3	33.6
30-day	21.9	23.7	22.8	23.1	21.6	22.4	21.5	21.2	19.9	19.8
Daily	4.9	5.8	5.6	6.0	6.0	5.8	6.0	6.0	5.6	5.0

*"Lifetime" refers to use at least once during a respondent's lifetime. "Annual" refers to use at least once during the year preceding an individual's response to the survey. "30-day" refers to use at least once during the 30 days preceding an individual's response to the survey.

Prevalence of lifetime,* annual, and use within the last 30 days for marijuana remained stable among 10th- and 12th-graders surveyed between 2003 and 2004. However, 8th-graders reported a significant decline in 30-day use and a significant increase in perceived harmfulness of smoking marijuana once or twice and regularly⁽³⁾. Trends in disapproval of using marijuana once or twice and occasionally rose among 8th-graders as well, and 10th-graders reported an increase in disapproval of occasional and regular use for the same period⁽³⁾.

Effects on the Brain

Scientists have learned a great deal about how THC acts in the brain to produce its many effects. When someone smokes marijuana, THC rapidly passes from the lungs into the bloodstream, which carries the chemical to organs throughout the body, including the brain.

In the brain, THC connects to specific sites called cannabinoid receptors on nerve cells and influences the activity of those cells. Some brain areas have many cannabinoid receptors; others

have few or none. Many cannabinoid receptors are found in the parts of the brain that influence pleasure, memory, thought, concentration, sensory and time perception, and coordinated movement⁽⁴⁾.

The short-term effects of marijuana can include problems with memory and learning; distorted perception; difficulty in thinking and problem solving; loss of coordination; and increased heart rate. Research findings for long-term marijuana abuse indicate some changes in the brain similar to those seen after long-term abuse of other major drugs. For example, cannabinoid (THC or synthetic forms of THC) withdrawal in chronically exposed animals leads to an increase in the activation of the stress-response system⁽⁵⁾ and changes in the activity of nerve cells containing dopamine⁽⁶⁾. Dopamine neurons are involved in the regulation of motivation and reward, and are directly or indirectly affected by all drugs of abuse.

Effects on the Heart

One study has indicated that an abuser's risk of heart attack more than quadruples in the first hour after smoking marijuana⁽⁷⁾. The researchers suggest that such an effect might occur from marijuana's effects on blood pressure and heart rate and reduced oxygen-carrying capacity of blood.

Effects on the Lungs

A study of 450 individuals found that people who smoke marijuana frequently but do not smoke tobacco have more health problems and miss more days of work than nonsmokers⁽⁸⁾. Many of the extra sick days among the marijuana smokers in the study were for respiratory illnesses.

Even infrequent abuse can cause burning and stinging of the mouth and throat, often accompanied by a heavy cough. Someone who smokes marijuana regularly may have many of the same respiratory problems that tobacco smokers do, such as daily cough and phlegm production, more frequent acute chest illness, a heightened risk of lung infections, and a greater tendency to obstructed airways⁽⁹⁾. Smoking marijuana possibly increases the likelihood of developing cancer of the head or neck. A study comparing 173 cancer patients and 176 healthy individuals produced evidence that marijuana smoking doubled or tripled the risk of these cancers⁽¹⁰⁾.

Marijuana abuse also has the potential to promote cancer of the lungs and other parts of the respiratory tract because it contains irritants and carcinogens^(9, 11). In fact, marijuana smoke contains 50 to 70 percent more carcinogenic hydrocarbons than does tobacco smoke⁽¹²⁾. It also induces high levels of an enzyme that

converts certain hydrocarbons into their carcinogenic form—levels that may accelerate the changes that ultimately produce malignant cells⁽¹³⁾. Marijuana users usually inhale more deeply and hold their breath longer than tobacco smokers do, which increases the lungs' exposure to carcinogenic smoke. These facts suggest that, puff for puff, smoking marijuana may be more harmful to the lungs than smoking tobacco.

Other Health Effects

Some of marijuana's adverse health effects may occur because THC impairs the immune system's ability to fight disease. In laboratory experiments that exposed animal and human cells to THC or other marijuana ingredients, the normal disease-preventing reactions of many of the key types of immune cells were inhibited⁽¹⁴⁾. In other studies, mice exposed to THC or related substances were more likely than unexposed mice to develop bacterial infections and tumors^(15, 16).

Effects of Heavy Marijuana Use on Learning and Social Behavior

Research clearly demonstrates that marijuana has the potential to cause problems in daily life or make a person's existing problems worse. Depression⁽¹⁷⁾, anxiety⁽¹⁷⁾, and personality disturbances⁽¹⁸⁾ have been associated with chronic marijuana use. Because marijuana compromises the ability to learn and remember information, the more a per-

son uses marijuana the more he or she is likely to fall behind in accumulating intellectual, job, or social skills. Moreover, research has shown that marijuana's adverse impact on memory and learning can last for days or weeks after the acute effects of the drug wear off^(19, 20, 25).

Students who smoke marijuana get lower grades and are less likely to graduate from high school, compared with their nonsmoking peers^(21, 22, 23, 24). A study of 129 college students found that, among those who smoked the drug at least 27 of the 30 days prior to being surveyed, critical skills related to attention, memory, and learning were significantly impaired, even after the students had not taken the drug for at least 24 hours⁽²⁰⁾. These "heavy" marijuana abusers had more trouble sustaining and shifting their attention and in registering, organizing, and using information than did the study participants who had abused marijuana no more than 3 of the previous 30 days. As a result, someone who smokes marijuana every day may be functioning at a reduced intellectual level all of the time.

More recently, the same researchers showed that the ability of a group of long-term heavy marijuana abusers to recall words from a list remained impaired for a week after quitting, but returned to normal within 4 weeks⁽²⁵⁾. Thus, some cognitive abilities may be restored in individuals who quit smoking marijuana, even after long-term heavy use.

Workers who smoke marijuana are more likely than their coworkers to have problems on the job. Several studies associate workers' marijuana smoking with increased absences, tardiness, accidents, workers' compensation claims, and job turnover. A study among postal workers found that employees who tested positive for marijuana on a pre-employment urine drug test had 55 percent more industrial accidents, 85 percent more injuries, and a 75-percent increase in absenteeism compared with those who tested negative for marijuana use⁽²⁶⁾. In another study, heavy marijuana abusers reported that the drug impaired several important measures of life achievement including cognitive abilities, career status, social life, and physical and mental health⁽²⁷⁾.

Effects of Exposure During Pregnancy

Research has shown that some babies born to women who abused marijuana during their pregnancies display altered responses to visual stimuli⁽²⁸⁾, increased tremulousness, and a high-pitched cry, which may indicate neurological problems in development⁽²⁹⁾. During the pre-school years, marijuana-exposed children have been observed to perform tasks involving sustained attention and memory more poorly than nonexposed children do^(30, 31). In the school years, these children are more likely to exhibit deficits in problem-solving skills, memory, and the ability to remain attentive⁽³⁰⁾.

Addictive Potential

Long-term marijuana abuse can lead to addiction for some people; that is, they abuse the drug compulsively even though it interferes with family, school, work, and recreational activities. Drug craving and withdrawal symptoms can make it hard for long-term marijuana smokers to stop abusing the drug. People trying to quit report irritability, sleeplessness, and anxiety⁽³²⁾. They also display increased aggression on psychological tests, peaking approximately one week after the last use of the drug⁽³³⁾.

Genetic Vulnerability

Scientists have found that whether an individual has positive or negative sensations after smoking marijuana can be influenced by heredity. A 1997 study demonstrated that identical male twins were more likely than nonidentical male twins to report similar responses to marijuana abuse, indicating a genetic basis for their response to the drug⁽³⁴⁾. (Identical twins share all of their genes.)

It also was discovered that the twins' shared or family environment before age 18 had no detectable influence on their response to marijuana. Certain environmental factors, however, such as the availability of marijuana, expectations about how the drug would affect them, the influence of friends and social contacts, and other factors that differentiate experiences of identical twins were found to have an important effect.⁽³⁴⁾

Treating Marijuana Problems

The latest treatment data indicate that, in 2002, marijuana was the primary drug of abuse in about 15 percent (289,532) of all admissions to treatment facilities in the United States. Marijuana admissions were primarily male (75 percent), White (55 percent), and young (40 percent were in the 15–19 age range). Those in treatment for primary marijuana abuse had begun use at an early age; 56 percent had abused it by age 14 and 92 percent had abused it by 18⁽³⁵⁾.

One study of adult marijuana abusers found comparable benefits from a 14-session cognitive-behavioral group treatment and a 2-session individual treatment that included motivational interviewing and advice on ways to reduce marijuana use. Participants were mostly men in their early thirties who had smoked marijuana daily for more than 10 years. By increasing patients' awareness of what triggers their marijuana

abuse, both treatments sought to help patients devise avoidance strategies. Abuse, dependence symptoms, and psychosocial problems decreased for at least 1 year following both treatments; about 30 percent of the patients were abstinent during the last 3-month followup period⁽³⁶⁾.

Another study suggests that giving patients vouchers that they can redeem for goods—such as movie passes, sporting equipment, or vocational training—may further improve outcomes⁽³⁷⁾.

Although no medications are currently available for treating marijuana abuse, recent discoveries about the workings of the THC receptors have raised the possibility of eventually developing a medication that will block the intoxicating effects of THC. Such a medication might be used to prevent relapse to marijuana abuse by lessening or eliminating its appeal.

References

¹ *Results from the 2004 National Survey on Drug Use and Health: National Findings* (Office of Applied Studies, NSDUH Series H-27, DHHS Publication No. SMA 05-4061). Rockville, MD, 2004. NSDUH is an annual survey conducted by the Substance Abuse and Mental Health Services Administration. Copies of the latest survey are available from the National Clearinghouse for Alcohol and Drug Information at 800-729-6686.

² These data are from the annual Drug Abuse Warning Network, funded by the Substance Abuse and Mental Health Services Administration, DHHS. The survey provides information about emergency department visits that are induced by or related to the use of an illicit drug or the nonmedical use of a legal drug. The latest data are available at 800-729-6686 or online at www.samhsa.gov.

- ³ These data are from the 2005 Monitoring the Future Survey, funded by the National Institute on Drug Abuse, National Institutes of Health, DHHS, 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.
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