

Marijuana

Marijuana is the most commonly abused illicit drug in the United States. It is a dry, shredded green and brown mix of flowers, stems, seeds, and leaves derived from the hemp plant *Cannabis sativa*. The main active chemical in marijuana is delta-9-tetrahydrocannabinol, or THC for short.

How Is Marijuana Abused?

Marijuana is usually smoked as a cigarette (joint) or in a pipe. It is also smoked in blunts, which are cigars that have been emptied of tobacco and refilled with marijuana. Since the blunt retains the tobacco leaf used to wrap the cigar, this mode of delivery combines marijuana's active ingredients with nicotine and other harmful chemicals. Marijuana can 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.

How Does Marijuana Affect 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

the brain and other organs throughout the body.

THC acts upon specific sites in the brain, called cannabinoid receptors, kicking off a series of cellular reactions that ultimately lead to the "high" that users experience when they smoke marijuana. Some brain areas have many cannabinoid receptors; others have few or none. The highest density of cannabinoid receptors are found in parts of the brain that influence pleasure, memory, thinking, concentrating, sensory and time perception, and coordinated movement.¹

Not surprisingly, marijuana intoxication can cause distorted perceptions, impaired coordination, difficulty in thinking and problemsolving, and problems with learning and memory. Research has shown that marijuana's adverse impact on learning and memory can last for days or weeks after the acute effects of the drug wear off.² As a result, someone who smokes marijuana every day may be functioning at a suboptimal intellectual level all of the time.

Research on the long-term effects of marijuana abuse indicates some changes in the brain similar to those seen after long-term abuse of other major drugs. For example, cannabinoid withdrawal in chronically exposed animals leads to an increase

in the activation of the stress-response system³ and to changes in the activity of nerve cells containing dopamine.⁴ Dopamine neurons are involved in the regulation of motivation and reward, and are directly or indirectly affected by nearly all drugs of abuse.

Addictive Potential

Long-term marijuana abuse can lead to addiction; that is, compulsive drug seeking and abuse despite the known harmful effects upon social functioning in the context of family, school, work, and recreational activities. Long-term marijuana abusers trying to quit report irritability, sleeplessness, decreased appetite, anxiety, and drug craving, all of which make it difficult to quit. These withdrawal symptoms begin within about 1 day following abstinence, peak at 2–3 days, and subside within 1 or 2 weeks following drug cessation.⁵

Marijuana and Mental Health

A number of studies have shown an association between chronic marijuana use and increased rates of anxiety, depression, and schizophrenia. Some of these studies have shown age at first use to be a factor, where early use is a marker of vulnerability to later problems. However, at this time, it is not clear whether marijuana use causes mental problems, exacerbates them, or is used in attempt to self-medicate symptoms already in existence. Chronic marijuana use, especially in a very young person, may also be a marker of risk for mental illnesses—including addiction—stem-

ming from genetic or environmental vulnerabilities, such as early exposure to stress or violence. Currently, the strongest evidence links marijuana use and schizophrenia and/or related disorders.⁶ High doses of marijuana can produce an acute psychotic reaction; in addition, use of the drug may trigger the onset or relapse of schizophrenia in vulnerable individuals.

What Other Adverse Effects Does Marijuana Have on Health?

Effects on the Heart

Marijuana increases 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.⁷ This may be due to the increased heart rate as well as effects of marijuana on heart rhythms, causing palpitations and arrhythmias. This risk may be greater in aging populations or those with cardiac vulnerabilities.

Effects on the Lungs

Numerous studies have shown marijuana smoke to contain carcinogens and to be an irritant to the lungs. In fact, marijuana smoke contains 50–70 percent more carcinogenic hydrocarbons than does tobacco smoke. Marijuana users usually inhale more deeply and hold their breath longer than tobacco smokers do, which further increase the lungs' exposure to carcinogenic smoke. Marijuana

smokers show dysregulated growth of epithelial cells in their lung tissue, which could lead to cancer;⁸ however, a recent case-controlled study found no positive associations between marijuana use and lung, upper respiratory, or upper digestive tract cancers.⁹ Thus, the link between marijuana smoking and these cancers remains unsubstantiated at this time.

Nonetheless, marijuana smokers can have many of the same respiratory problems as tobacco smokers, such as daily cough and phlegm production, more frequent acute chest illness, and a heightened risk of lung infections. 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.¹⁰ Many of the extra sick days among the marijuana smokers in the study were for respiratory illnesses.

Effects on Daily Life

Research clearly demonstrates that marijuana has the potential to cause problems in daily life or make a person's existing problems worse. In one study, heavy marijuana abusers reported that the drug impaired several important measures of life achievement, including physical and mental health, cognitive abilities, social life, and career status.¹¹ Several studies associate workers' marijuana smoking with increased absences, tardiness, accidents, workers' compensation claims, and job turnover.

What Treatment Options Exist?

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

The latest treatment data indicate that in 2006 marijuana was the most common illicit drug of abuse and was responsible for about 16 percent (289,988) of all admissions to treatment facilities in the United States. Marijuana admissions were primarily male (73.8 percent), White (51.5 percent), and young (36.1 percent were in the 15–19 age range). Those in treatment for primary marijuana abuse had begun use at an early age: 56.2 percent had abused the drug by age 14, and 92.5 percent had abused it by age 18.^{††}

How Widespread Is Marijuana Abuse?

National Survey on Drug Use and Health (NSDUH)^{†††}

According to the National Survey on Drug Use and Health, in 2007, 14.4 million Americans aged 12 or older

used marijuana at least once in the month prior to being surveyed, which is similar to the 2006 rate. About 6,000 people a day in 2007 used marijuana for the first time—2.1 million Americans. Of these, 62.2 percent were under age 18.

Monitoring the Future Survey^{†††}

The Monitoring the Future survey indicates that marijuana use among 8th-, 10th-, and 12th-graders—which has

shown a consistent decline since the mid-1990s—appears to have leveled off, with 10.9 percent of 8th-graders, 23.9 percent of 10th-graders, and 32.4 percent of 12th-graders reporting past-year use. Heightening the concern over this stabilization in use is the finding that, compared to last year, the proportion of 8th-graders who perceived smoking marijuana as harmful and the proportion who disapprove of the drug’s use have decreased.

Percentage of 8th-Graders Who Have Used Marijuana											
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Lifetime*	22.2	22.0	20.3	20.4	19.2	17.5	16.3	16.5	15.7	14.2	14.6
Past Year	16.9	16.5	15.6	15.4	14.6	12.8	11.8	12.2	11.7	10.3	10.9
Past Month	9.7	9.7	9.1	9.2	8.3	7.5	6.4	6.6	6.5	5.7	5.8
Daily	1.1	1.4	1.3	1.3	1.2	1.0	0.8	1.0	1.0	0.8	0.9

Percentage of 10th-Graders Who Have Used Marijuana											
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Lifetime*	39.6	40.9	40.3	40.1	38.7	36.4	35.1	34.1	31.8	31.0	29.9
Past Year	31.1	32.1	32.2	32.7	30.3	28.2	27.5	26.6	25.2	24.6	23.9
Past Month	18.7	19.4	19.7	19.8	17.8	17.0	15.9	15.2	14.2	14.2	13.8
Daily	3.6	3.8	3.8	4.5	3.9	3.6	3.2	3.1	2.8	2.8	2.7

Percentage of 12th-Graders Who Have Used Marijuana

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Lifetime*	49.1	49.7	48.8	49.0	47.8	46.1	45.7	44.8	42.3	41.8	42.6
Past Year	37.5	37.8	36.5	37.0	36.2	34.9	34.3	33.6	31.5	31.7	32.4
Past Month	22.8	23.1	21.6	22.4	21.5	21.2	19.9	19.8	18.3	18.8	19.4
Daily	5.6	6.0	6.0	5.8	6.0	6.0	5.6	5.0	5.0	5.1	5.4

* "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.

Other Information Sources

For additional information on marijuana, please visit www.marijuana-info.org.

Data Sources

† For street terms searchable by drug name, street term, cost and quantities, drug trade, and drug use, visit www.whitehousedrugpolicy.gov/streetterms/default.asp.

†† These data are from the *Treatment Episode Data Set (TEDS) Highlights—2006: National Admissions to Substance Abuse Treatment Services* (Office of Applied Studies, DASIS Series: S-40, DHHS Publication No. SMA 08–4313, Rockville, MD, 2008), funded by the Substance Abuse and Mental Health Services Administration. The latest data are available at 800–729–6686 or online at www.samhsa.gov.

††† *Results from the 2007 National Survey on Drug Use and Health: National Findings* (Office of Applied Studies, NSDUH Series H–34, DHHS Publication No. SMA 08–4343, Rockville, MD, 2008). 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 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.

References

- Herkenham M, Lynn A, Little MD, et al. Cannabinoid receptor localization in the brain. *Proc Natl Acad Sci, USA* 87(5):1932–1936, 1990.
- Pope HG, Gruber AJ, Hudson JI, Huestis MA, Yurgelun-Todd D. Neuropsychological performance in long-term cannabis users. *Arch Gen Psychiatry* 58(10):909–915, 2001.
- Rodríguez de Fonseca F, Carrera MRA, Navarro M, Koob GF, Weiss F. Activation of corticotropin-releasing factor in the limbic system during cannabinoid withdrawal. *Science* 276(5321):2050–2054, 1997.
- Diana M, Melis M, Muntoni AL, Gessa GL. Mesolimbic dopaminergic decline after cannabinoid withdrawal. *Proc Natl Acad Sci, USA* 95(17):10269–10273, 1998.

⁵ Budney AJ, Vandrey RG, Hughes JR, Thostenson JD, Bursac Z. Comparison of cannabis and tobacco withdrawal: Severity and contribution to relapse. *J Subst Abuse Treat* 35(4):362–368, 2008.

⁶ Moore TH, Zammit S, Lingford-Hughes A, et al. Cannabis use and risk of psychotic or affective mental health outcomes: A systematic review. *Lancet* 370(9584):319–328, 2007.

⁷ Mittleman MA, Lewis RA, Maclure M, Sherwood JB, Muller JE. Triggering myocardial infarction by marijuana. *Circulation* 103(23):2805–2809, 2001.

⁸ Tashkin DP. Smoked marijuana as a cause of lung injury. *Monaldi Arch Chest Dis* 63(2):92–100, 2005.

⁹ Hashibe M, Morgenstern H, Cui Y, et al. Marijuana use and the risk of lung and upper aerodigestive tract cancers: Results of a population-based case-control study. *Cancer Epidemiol Biomarkers Prev* 15(10):1829–1834, 2006.

¹⁰ Polen MR, Sidney S, Tekawa IS, Sadler M, Friedman GD. Health care use by frequent marijuana smokers who do not smoke tobacco. *West J Med* 158(6):596–601, 1993.

¹¹ Gruber AJ, Pope HG, Hudson JI, Yurgelun-Todd D. Attributes of long-term heavy cannabis users: A case control study. *Psychological Med* 33(8):1415–1422, 2003.