

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; 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, thoughts, concentration, sensory and time perception, and coordinated movement.¹

Not surprisingly, marijuana intoxication can cause distorted perceptions, impaired coordination, difficulty in thinking and problem solving, 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 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 all drugs of abuse.

Addictive Potential Long-term marijuana abuse can lead to addiction; that is, compulsive drug seeking and abuse despite its 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, suicidal ideation, 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 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, stemming from genetic or environmental vulnerabilities, such as early exposure to stress or violence. At the present time, the strongest evidence links marijuana use and schizophrenia and/or related disorders⁶. High doses of marijuana can produce an acute psychotic reaction, and research suggests that in vulnerable individuals, marijuana use may be a factor that increases risk for the disease.

What Other Adverse Effect Does Marijuana Have on Health?

Effects on the Heart One study found 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 outcome might occur from marijuana's effects on blood pressure and heart rate (it increases both) and reduced oxygen-carrying capacity of blood.

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 to 70 percent more carcinogenic hydrocarbons than tobacco smoke. Marijuana users usually inhale more deeply and hold their breath longer than tobacco smokers do, which further increases 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, a heightened risk of lung infections, and a greater tendency toward obstructed airways. 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 have been successful 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 it by age 14 and 92.5 percent had abused it by age 18.**

How Widespread is Marijuana Abuse?

According to the National Survey on Drug Use and Health, in 2006, 14.8 million Americans age 12 or older used marijuana at least once in the month prior to being surveyed, which is similar to the 2005 rate. About 6,000 people a day in 2006 used marijuana for the first time—2.2 million Americans. Of these, 63.3 percent were under age 18.***

Monitoring the Future Survey According to the 2007 Monitoring the Future survey—a national survey of 8th, 10th, and 12th graders, marijuana use has been declining since the late 1990s. Between 2000 and 2007, past-year use decreased more than 20 percent in all three grades combined. Nevertheless, marijuana use remains at unacceptably high levels, with more than 40 percent of high school seniors reporting use at least once in their lifetimes. ****

**Percentage of 8th-Graders Who Have Used Marijuana:
Monitoring the Future Study, 2007**

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|------------|-------|-------|-------|-------|-------|-------|-------|
| Lifetime | 16.7% | 19.9% | 23.1% | 22.6% | 22.2% | 22.0% | 20.3% |
| Past Year | 13.0 | 15.8 | 18.3 | 17.7 | 16.9 | 16.5 | 15.6 |
| Past Month | 7.8 | 9.1 | 11.3 | 10.2 | 9.7 | 9.7 | 9.1 |
| Daily | 0.7 | 0.8 | 1.5 | 1.1 | 1.1 | 1.4 | 1.3 |

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|------------|-------|-------|-------|-------|-------|------|------|
| Lifetime | 20.4% | 19.2% | 17.5% | 16.3% | 16.5% | 15.7 | 14.2 |
| Past Year | 15.4 | 14.6 | 12.8 | 11.8 | 12.2 | 11.7 | 10.3 |
| Past Month | 9.2 | 8.3 | 7.5 | 6.4 | 6.6 | 6.5 | 5.7 |
| Daily | 1.3 | 1.2 | 1.0 | 0.8 | 1.0 | 1.0 | 0.8 |

**Percentage of 10th-Graders Who Have Used Marijuana:
Monitoring the Future Study, 2007**

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|------------|-------|-------|-------|-------|-------|-------|-------|
| Lifetime | 30.4% | 34.1% | 39.8% | 42.3% | 39.6% | 40.9% | 40.3% |
| Past Year | 25.2 | 28.7 | 33.6 | 34.8 | 31.1 | 32.1 | 32.2 |
| Past Month | 15.8 | 17.2 | 20.4 | 20.5 | 18.7 | 19.4 | 19.7 |
| Daily | 2.2 | 2.8 | 3.5 | 3.7 | 3.6 | 3.8 | 3.8 |

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|------------|-------|-------|-------|-------|-------|-------|-------|
| Lifetime | 40.1% | 38.7% | 36.4% | 35.1% | 34.1% | 31.8% | 31.0% |
| Past Year | 32.7 | 30.3 | 28.2 | 27.5 | 26.6 | 25.2 | 24.6 |
| Past Month | 19.8 | 17.8 | 17.0 | 15.9 | 15.2 | 14.2 | 14.2 |
| Daily | 4.5 | 3.9 | 3.6 | 3.2 | 3.1 | 2.8 | 2.8 |

**Percentage of 12th-Graders Who Have Used Marijuana
Monitoring the Future Study, 2007**

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|------------|-------|-------|-------|-------|-------|-------|-------|
| Lifetime | 38.2% | 41.7% | 44.9% | 49.6% | 49.1% | 49.7% | 48.8% |
| Past Year | 30.7 | 34.7 | 35.8 | 38.5 | 37.5 | 37.8 | 36.5 |
| Past Month | 19.0 | 21.2 | 21.9 | 23.7 | 22.8 | 23.1 | 21.6 |
| Daily | 3.6 | 4.6 | 4.9 | 5.8 | 5.6 | 6.0 | 6.0 |

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|------------|-------|-------|-------|-------|-------|-------|-------|
| Lifetime | 49.0% | 47.8% | 46.1% | 45.7% | 44.8% | 42.3% | 41.8% |
| Past Year | 37.0 | 36.2 | 34.9 | 34.3 | 33.6 | 31.5 | 31.7 |
| Past Month | 22.4 | 21.5 | 21.2 | 19.9 | 19.8 | 18.3 | 18.8 |
| Daily | 5.8 | 6.0 | 6.0 | 5.6 | 5.0 | 5.0 | 5.1 |

"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.



Cannabis (drug)

From Wikipedia, the free encyclopedia

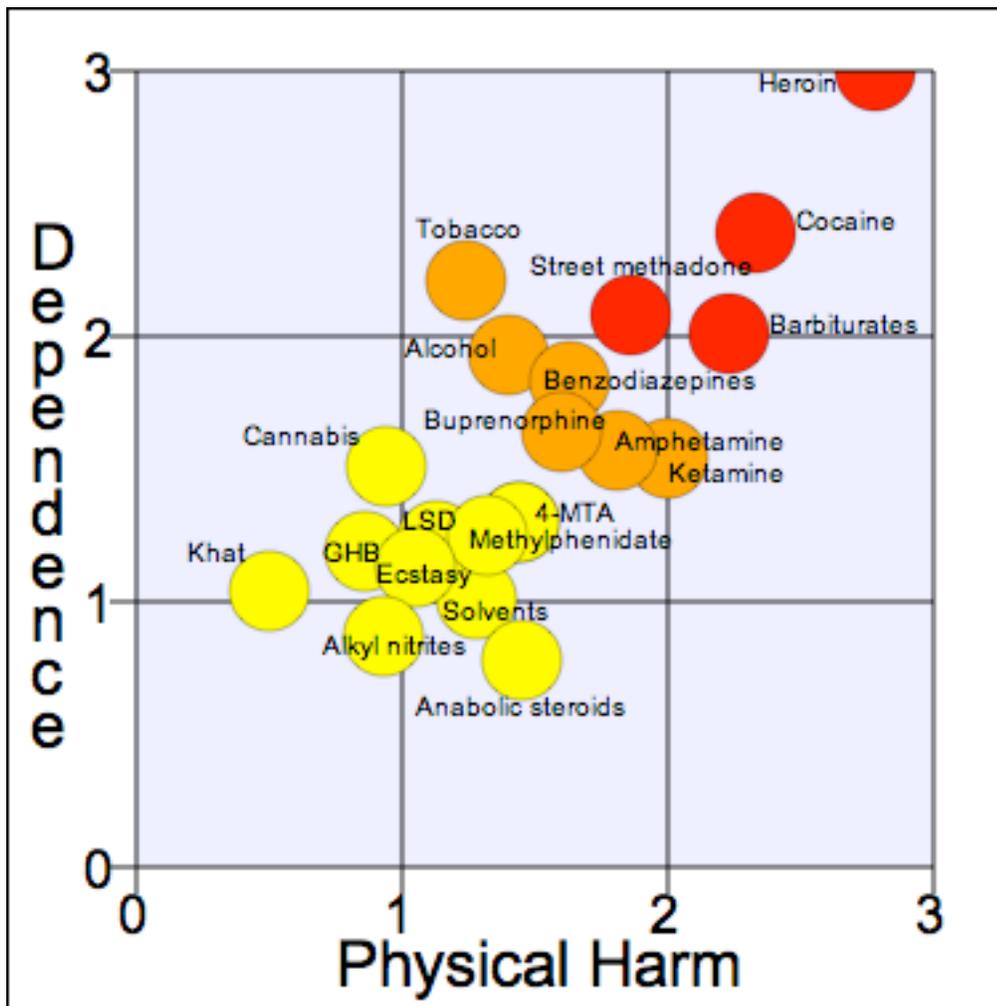
Health issues

Smoking of cannabis is the most harmful method of consumption, since the combination of inhalation of [smoke](#) from [organic materials](#) such as tobacco, wood, gasoline and cannabis can cause various health problems.^[20]

A 2007 study by the Canadian government found cannabis smoke contained more toxic substances than tobacco smoke.^[25] The study determined that marijuana smoke contained 20 times more [ammonia](#), and five times more [hydrogen cyanide](#) and [nitrogen oxides](#) than tobacco smoke. In spite of this, recent studies have been unable to demonstrate a direct link between lung cancer and frequent direct inhalation of marijuana smoke. While many researchers have failed to find a correlation,^{[26][27]} some researchers still conclude that marijuana smoke poses a higher risk of lung cancer than tobacco.^[28]

Cannabis use has been assessed by several studies to be [correlated with the development](#) of anxiety, psychosis and depression,^{[30][31]} however, [no causal mechanism has been proven](#), and the meaning of the correlation and its direction is a subject of debate that has not been resolved in the scientific community. Some studies assess that the causality is more likely to involve a path from cannabis use to psychotic symptoms rather than a path from psychotic symptoms to cannabis use,^[32] while others assess the opposite direction of the causality, or hold cannabis to only form parts of a "causal constellation", while not inflicting mental health problems that would not have occurred in the absence of the cannabis use.^{[33][34]}

Studies have also shown links between heavy long-term use (over five joints daily over several years) and incidence of heart attacks, strokes, as well as abnormalities in the [amygdala](#) and [hippocampus](#) regions of the brain.^{[35][36]}



Comparison of physical harm and dependence regarding various drugs (the British medical journal [The Lancet](#)[24])

Gateway drug theory

Further information: [Gateway drug theory](#)

Some claim that trying marijuana increases the probability that users will eventually use harder drugs. This hypothesis has been one of the central pillars of cannabis drug policy in the United States, though the validity and implications of these hypotheses are highly debated.[37] Studies have shown that tobacco smoking is a better predictor of concurrent illicit hard drug use than smoking cannabis.[38]

No widely accepted study has ever demonstrated a cause-and-effect relationship between the use of marijuana and the later use of harder drugs like heroin and cocaine.

A 2005 comprehensive review of the literature on the cannabis gateway hypothesis found that pre-existing traits may predispose users to addiction in general, the availability of multiple drugs in a given setting confounds predictive patterns in their usage, and drug sub-cultures are more influential than cannabis itself. The study called for further research on "social context, individual characteristics, and drug effects" to discover the actual relationships between cannabis and the use of other drugs.[39]

The main variant of the gateway hypothesis is that people, upon trying cannabis for the first time and not finding it dangerous, are then tempted to try other, harder drugs. In such a scenario, a new user of cannabis who feels there is a difference between anti-drug information and their own experiences will apply this distrust to public information of other, more powerful drugs.[citation needed] Some studies state that while there is no proof for this gateway theory, young cannabis users should still be considered as a risk group for intervention

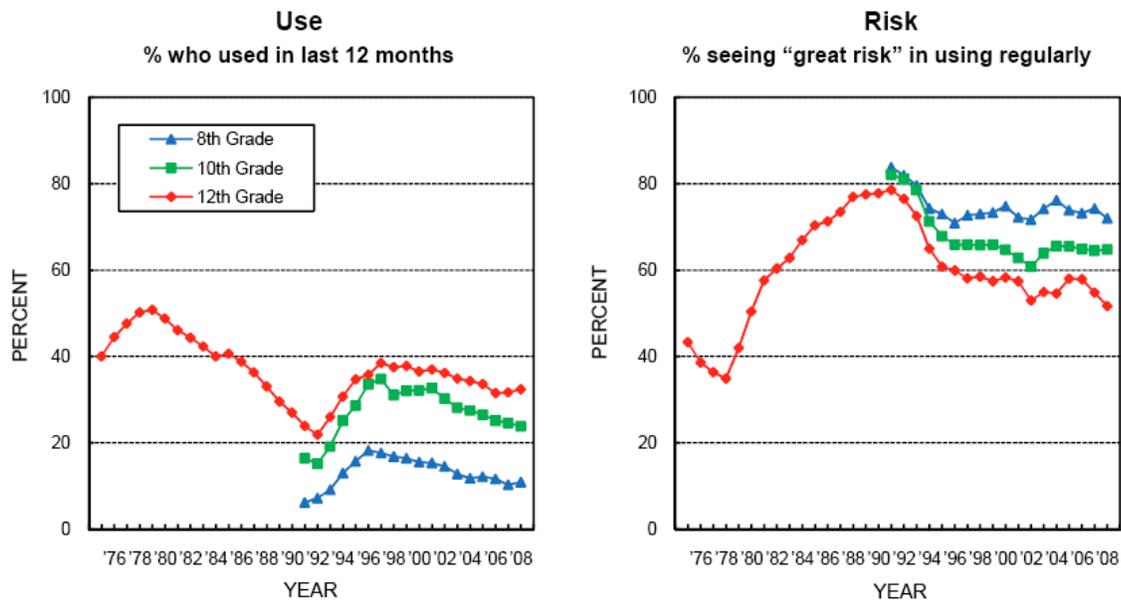
programs.[40] Other findings indicate that hard drug users are likely to be "poly-drug" users, and that interventions must address the use of multiple drugs instead of a single hard drug.[41]

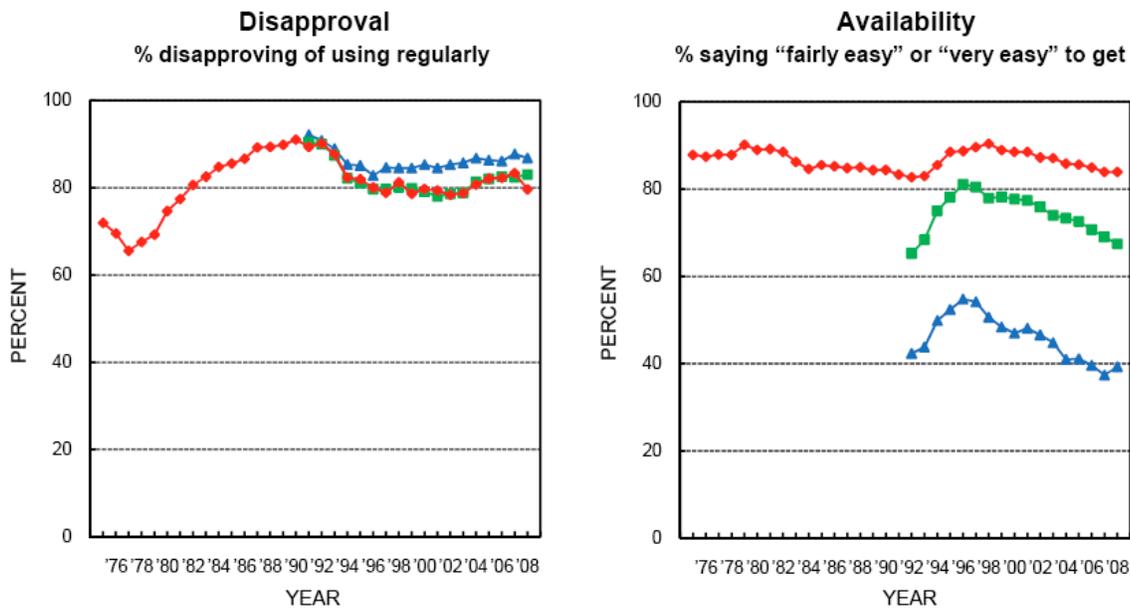
Another gateway hypothesis is that while cannabis is not as harmful or addictive as any other drugs, a gateway effect may be detected as a result of the "common factors" involved with using any illegal drug. Because of its illegal status, cannabis users are more likely to be in situations which allow them to become acquainted with people who use and sell other illegal drugs.[42][43] By this argument, some studies have shown that alcohol and tobacco may also be regarded as gateway drugs.[38] At least one source has suggested that the practice of mixing tobacco with cannabis can be a gateway to nicotine dependence.[44]

Cannabis use disorders (CUD) encompass the two distinct diagnoses of abuse and dependence, defined in the DSM-IV by the same criteria as for other substance use disorders, according to the American Psychiatric Association (APA). CUD includes neurocognitive impairments such as problems with psychomotor function, attention, memory, and learning which occur during intoxication, some of which persist after a brief period of abstinence.

According to research 24.6% of all cannabis-using students met the definition for CUD.[1]

FIGURE 11
Marijuana: Trends in Annual Use, Risk, Disapproval, and Availability
 Grades 8, 10, and 12





Source. The Monitoring the Future study, the University of Michigan.

Marijuana Use Linked to Increased Risk of Testicular Cancer

Risk appears to be elevated particularly among frequent and/or long-term users

SEATTLE — February 9 — Frequent and/or long-term marijuana use may significantly increase a man's risk of developing the most aggressive type of testicular cancer, according to a study by researchers at Fred Hutchinson Cancer Research Center. The study results were published online Feb. 9 in the journal *Cancer*.

The researchers found that being a marijuana smoker at the time of diagnosis was associated with a 70 percent increased risk of testicular cancer. The risk was particularly elevated (about twice that of those who never smoked marijuana) for those who used marijuana at least weekly and/or who had long-term exposure to the substance beginning in adolescence.

The results also suggested that the association with marijuana use might be limited to nonseminoma, a fast-growing testicular malignancy that tends to strike early, between ages 20 and 35, and accounts for about 40 percent of all testicular-cancer cases.

Since the 1950s, the incidence of the two main cellular subtypes of testicular cancer, nonseminoma and seminoma - the more common, slower growing kind that strikes men in their 30s and 40s - has increased by 3 percent to 6 percent per year in the U.S., Canada, Europe, Australia and New Zealand. During the same time period, marijuana use in North America, Europe and Australia has risen accordingly, which is one of several factors that led the researchers to hypothesize a potential association.

"Our study is not the first to suggest that some aspect of a man's lifestyle or environment is a risk factor for testicular cancer, but it is the first that has looked at marijuana use," said author Stephen M. Schwartz, M.P.H., Ph.D., an epidemiologist and member of the Public Health Sciences Division at the Hutchinson Center.

Established risk factors for testicular cancer include a family history of the disease, undescended testes

and abnormal testicular development. The disease is thought to begin in the womb, when some fetal germ cells (those that eventually make sperm in adulthood) fail to develop properly and become vulnerable to malignancy. Later, during adolescence and adulthood, it is thought that exposure to male sex hormones coaxes these cells to become cancerous.

"Just as the changing hormonal environment of adolescence and adulthood can trigger undifferentiated fetal germ cells to become cancerous, it has been suggested that puberty is a 'window of opportunity' during which lifestyle or environmental factors also can increase the risk of testicular cancer," said senior author Janet R. Daling, Ph.D., an epidemiologist who is also a member of the Center's Public Health Sciences Division. "This is consistent with the study's findings that the elevated risk of nonseminoma-type testicular cancer in particular was associated with marijuana use prior to age 18."

Chronic marijuana exposure has multiple adverse effects on the endocrine and reproductive systems, primarily decreased sperm quality. Other possible effects include decreased testosterone and male impotency. Because male infertility and poor semen quality also have been linked to an increased risk of testicular cancer, this further reinforced the researchers' hypothesis that marijuana use may be a risk factor for the disease.

Daling first got the idea to explore a possible association between marijuana use and testicular cancer about eight years ago, when she attended a talk by a physician at the University of Washington who presented findings that only two organs, the brain and the testes, had receptors for tetrahydrocannabinol, or THC, the main psychoactive component of marijuana. Since then, a number of other sites have been found to contain THC receptors, including the heart, uterus, spleen and immune-system cells.

The male reproductive system also naturally produces a cannabinoid-like chemical that is thought to have a protective effect against cancer. The authors speculate that marijuana use may disrupt this anti-tumor effect, which could be another explanation for the possible link between marijuana and increased risk of testicular cancer.

For the population-based, case-control study, Daling, Schwartz and colleagues interviewed 369 Seattle-Puget Sound-area men, ages 18 to 44, who had been diagnosed with testicular cancer about their history of marijuana use. For comparison purposes they also assessed marijuana use among 979 randomly selected age- and geography-matched healthy controls. (More than 90 percent of the cases and 80 percent of the controls in the study were Hispanic or non-Hispanic white men, due to the fact that testicular cancer is very rare in African-Americans, and because the Seattle-Puget Sound region has a relatively small African-American population.)

Study participants were also asked about other habits that may be correlated with marijuana use, including smoking and alcohol consumption. Even after statistically controlling for these lifestyle factors, as well as other risk factors, such as first-degree family history of testicular cancer and a history of undescended testes, marijuana use emerged as a significant, independent risk factor for testicular cancer.

The researchers emphasize that their results are not definitive, but rather open a door to more research questions.

"Our study is the first inkling that marijuana use may be associated with testicular cancer, and we still have a lot of unanswered questions," Schwartz said, such as why marijuana appears to be associated with only one type of testicular cancer. "We need to conduct additional research to see whether the association can be observed in other populations, and whether measurement of molecular markers connected to the pathways through which marijuana could influence testicular cancer development helps clarify any association that exists," he said.

In future studies the researchers plan to measure the expression of cannabinoid receptors in both seminomatous and nonseminomatous tumor tissue from the cases in the study, and to see whether variation in the genes for the receptors and other molecules involved in cannabinoid signaling influences the risk of testicular cancer.

In the meantime, Schwartz said, "What young men should know is that first, we know very little about the long-term health consequences of marijuana smoking, especially heavy marijuana smoking; and second, our study provides some evidence that testicular cancer could be one adverse consequence," he said. "So, in the absence of more certain information, a decision to smoke marijuana recreationally means that one is taking a chance on one's future health."

The National Cancer Institute, the National Institute on Drug Abuse and funds from the Hutchinson Center supported this research, which also involved researchers from the University of Washington, Vanderbilt University and Cincinnati Children's Research Foundation.

According to the National Cancer Institute, testicular cancer is very rare, accounting for only 1 percent of cancers in U.S. men. About 8,000 men are diagnosed with testicular cancer each year, and about 390 die of the disease annually. It is the most common form of cancer in men between the ages of 15 and 34 and is most common in white men, especially those of Scandinavian descent.

Note for media only: To arrange an interview with Daling or Schwartz or obtain a copy of the *Cancer* paper, "Association of Marijuana Use and the Incidence of Testicular Germ Cell Tumors," please contact Kristen Woodward, 206-667-5095 or kwoodwar@fhcrc.org.

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Marijuana May Shrink Parts of the Brain

by *HealthDay News*, St. Mary's General Hospital, June 2, 2008

People who use marijuana for a long time can develop abnormalities in their brains, Australian researchers report.

Although growing literature suggests that long-term marijuana use is associated with a wide range of adverse health consequences, many people believe it is relatively harmless and should be legalized, the researchers noted.

"However, this study shows long-term, heavy cannabis use causes significant brain injury, memory loss, difficulties learning new information, and psychotic symptoms, such as delusions of persecution [paranoia], delusions of mind-reading, and bizarre social behaviors in even non-vulnerable users," said lead researcher Murat Yucel, from the ORYGEN Research Centre and the Neuropsychiatry Centre at the University of Melbourne.

This new evidence plays an important role in further understanding the effects of marijuana and its impact on brain functioning, Yucel said. "The study is the first to show that long-term cannabis use can adversely affect all users, not just those in the high-risk categories such as the young, or those susceptible to mental illness, as previously thought," he said.

The report was published in the June issue of the *Archives of General Psychiatry*.

In the study, Yucel's team did high-resolution MRIs on 15 men who smoked more than five joints a day for more than 10 years. They compared those with scans of 16 men who did not use marijuana.

In addition, all the men took verbal memory tests and were examined for symptoms of psychiatric disorders.

"The more marijuana used, the more these individuals were likely to show reduced brain volumes in the hippocampus and amygdala, as well as being more likely to develop symptoms of psychotic disorders and to have significant memory impairment," Yucel said.

In fact, the hippocampus of marijuana users was 12 percent smaller, and the amygdala was 7.1 percent smaller

than among nonusers. In addition, men who used marijuana also had symptoms of psychiatric disorders, Yucel's group found.

The hippocampus is associated with the regulation of emotion and memory, while the amygdala controls fear and aggression.

"There is ongoing controversy concerning the long-term effects of cannabis on the brain," Yucel said. "These findings challenge the widespread perception of cannabis as having limited or no harmful effects on brain and behavior. Although modest use may not lead to significant neurotoxic effects, these results suggest that heavy daily use might indeed be toxic to human brain tissue."

One expert agrees that heavy marijuana use can have negative effects on the brain.

"These findings are not surprising," said Dr. Adam Bisaga, an assistant professor of psychiatry at Columbia University and an addiction psychiatrist at New York State Psychiatric Institute. "Chronic use of large amounts of any substance that is affecting neural transmission will most likely invoke adaptive changes and lead to the reorganization of neural networks, and possibly affect brain structures."

Heavy users of marijuana probably represent only a very small proportion of users, Bisaga said.

"It is not clear if any clinically significant changes can be seen in recreational, infrequent marijuana users, who were not studied here. These findings suggest that public health education, as well as screening, early recognition, and treatment of cannabis dependence, may prevent the progression of the disease and the loss of brain function and related psychiatric complications," Bisaga said.