WHAT SHOULD WE KNOW ABOUT MARIJUANA

Marijuana is the most commonly used illicit drug in the U.S. The use of marijuana can produce adverse physical, mental, emotional, and behavioral effects.

What is marijuana?

Marijuana—often called pot, grass, reefer, weed, herb, Mary Jane, or MJ—is a greenish-gray mixture of the dried, shredded leaves, stems, seeds, and flowers of Cannabis sativa—the hemp plant. Most users smoke marijuana in hand-rolled cigarettes called joints, among other names; some use pipes or water pipes called bongs. Marijuana cigars, or blunts, are also popular. To make blunts, users slice open cigars, remove some of the tobacco, and mix the remainder with marijuana. Marijuana also is used to brew tea and sometimes is mixed into foods.

How does marijuana use affect your brain and body?

As THC enters the brain, it causes the user to feel euphoric—or high—by acting on the brain's reward system, which is made up of regions that govern the response to pleasurable things like sex and chocolate, as well as to most drugs of abuse. THC activates the reward system in the same way that nearly all drugs of abuse do: by stimulating brain cells to release the chemical dopamine.

Along with euphoria, relaxation is another frequently reported effect in human studies. Other effects, which vary dramatically among different users, include heightened sensory perception (e.g., brighter colors), laughter, altered perception of time, and increased appetite. After a while, the euphoria subsides, and the user may feel sleepy or depressed. Occasionally, marijuana use may produce anxiety, fear, distrust, or panic.

Marijuana use impairs a person's ability to form new memories (see below) and to shift focus. THC also disrupts coordination and balance by binding to receptors in the cerebellum and basal ganglia—parts of the brain that regulate balance, posture, coordination, and reaction time. Therefore, learning, doing complicated tasks, participating in athletics, and driving are also affected.

Marijuana users who have taken large doses of the drug may experience an acute psychosis, which includes hallucinations, delusions, and a loss of the sense of personal identity. Short-term psychotic reactions to high concentrations of THC are distinct from longer-lasting, schizophrenia-like disorders that have been associated with the use of cannabis in vulnerable individuals.

Our understanding of marijuana's long-term brain effects is limited. Research findings on how chronic cannabis use affects brain structure, for example, have been inconsistent. It may be that the effects are too subtle for reliable detection by current techniques. A similar challenge arises in studies of the effects of chronic marijuana use on brain function. Although imaging studies (functional MRI; fMRI) in chronic users do show some consistent alterations, the relation of these changes to cognitive functioning is less clear. This

uncertainty may stem from confounding factors such as other drug use, residual drug effects (which can occur for at least 24 hours in chronic users), or withdrawal symptoms in long-term chronic users.

Marijuana, Memory, and the Hippocampus

Memory impairment from marijuana use occurs because THC alters how information is processed in the hippocampus, a brain area responsible for memory formation.

Brain image reveals high levels (shown in orange and yellow) of cannabinoid receptors in many areas, including the cortex, hippocampus, cerebellum, and nucleus accumbens (ventral striatum).

Most of the evidence supporting this assertion comes from animal studies. For example, rats exposed to THC in utero, soon after birth, or during adolescence, show notable problems with specific learning/memory tasks later in life. Moreover, cognitive impairment in adult rats is associated with structural and functional changes in the hippocampus from THC exposure during adolescence.

As people age, they lose neurons in the hippocampus, which decreases their ability to learn new information. Chronic THC exposure may hasten age-related loss of hippocampal neurons. In one study, rats exposed to THC every day for 8 months (approximately 30 percent of their life-span) showed a level of nerve cell loss (at 11 to 12 months of age) that equaled that of unexposed animals twice their age.

An enduring question in the field is whether individuals, who quit marijuana, even after long-term, heavy use, can recover some of their cognitive abilities. One study reports that the ability of long-term heavy marijuana users to recall words from a list was still impaired 1 week after they quit using, but returned to normal by 4 weeks. However, another study found that marijuana's effects on the brain can build up and deteriorate critical life skills over time. Such effects may be worse in those with other mental disorders, or simply by virtue of the normal aging process.

Effects on General Physical Health

Within a few minutes after inhaling marijuana smoke, an individual's heart rate speeds up, the bronchial passages relax and become enlarged, and blood vessels in the eyes expand, making the eyes look red. The heart rate—normally 70 to 80 beats per minute—may increase by 20 to 50 beats per minute, or may even double in some cases. Taking other drugs with marijuana can amplify this effect.

Limited evidence suggests that a person's risk of heart attack during the first hour after smoking marijuana is four times his or her usual risk. This observation could be partly explained by marijuana raising blood pressure (in some cases) and heart rate and reducing the blood's capacity to carry oxygen. Such possibilities need to be examined more closely, particularly since current marijuana users include adults from the baby boomer generation, who may have other cardiovascular risks that may increase their vulnerability.

Consequences of Marijuana Abuse

<u>Acute (present during intoxication)</u>

Impairs short-term memory
Impairs attention, judgment, and other cognitive functions
Impairs coordination and balance
Increases heart rate
Psychotic episodes

<u>Persistent (lasting longer than intoxication, but may not be permanent)</u>

Impairs memory and learning skills
Sleep impairment

<u>Long-term (cumulative effects of chronic abuse)</u>

Can lead to addiction
Increases risk of chronic cough, bronchitis
Increases risk of schizophrenia in vulnerable individuals
May increase risk of anxiety, depression, and a motivational syndrome*

* These are often reported co-occurring symptoms/disorders with chronic marijuana use. However, research has not yet determined whether marijuana is causal or just associated with these mental problems.

The smoke of marijuana, like that of tobacco, consists of a toxic mixture of gases and particulates, many of which are known to be harmful to the lungs. 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 illnesses, and a greater risk of lung infections. Even infrequent marijuana use can cause burning and stinging of the mouth and throat, often accompanied by a heavy cough. One study found that extra sick days used by frequent marijuana smokers were often because of respiratory illnesses.

In addition, marijuana has the potential to promote cancer of the lungs and other parts of the respiratory tract because it contains irritants and carcinogens—up to 70 percent more than tobacco smoke. It also induces high levels of an enzyme that converts certain hydrocarbons into their cancer-causing form, which could accelerate the changes that ultimately produce malignant cells. And since marijuana smokers generally inhale more deeply and hold their breath longer than tobacco smokers, the lungs are exposed longer to carcinogenic smoke. However, while several lines of evidence have suggested that marijuana use may lead to lung cancer, the supporting evidence is inconclusive.

Image of a red eye

Within a few minutes after inhaling marijuana smoke, an individual's heart rate speeds up, the bronchial passages relax and become enlarged, and blood vessels in the eyes expand, making the eyes look red.

A significant body of research demonstrates negative effects of THC on the function of various immune cells, both in vitro in cells and in vivo with test animals. However, no studies to date connect marijuana's uspected immune system suppression with greater incidence of infections or immune disorders in humans. One short (3-week) study found marijuana smoking to be associated with a few statistically significant negative effects on the immune function of AIDS patients; a second small study of college students also suggested the possibility of marijuana having adverse effects on immune system functioning. Thus, the combined evidence from animal studies plus the limited human data available seem to warrant additional research on the impact of marijuana on the immune system.

Is marijuana addictive?

Long-term marijuana use can lead to addiction; that is, people have difficulty controlling their drug use and cannot stop even though it interferes with many aspects of their lives. It is estimated that 9 percent of people who use marijuana will become dependent on it. The number goes up to about 1 in 6 in those who start using young (in their teens) and to 25-50 percent among daily users. Moreover, a study of over 300 fraternal and identical twin pairs found that the twin who had used marijuana before the age of 17 had elevated rates of other drug use and drug problems later on, compared with their twin who did not use before age 17.

According to the 2010 NSDUH, marijuana accounted for 4.5 million of the estimated 7.1 million Americans dependent on or abusing illicit drugs. In 2009, approximately 18 percent of people aged 12 and older entering drug abuse treatment programs reported marijuana as their primary drug of abuse; 61 percent of persons under 15 reported marijuana as their primary drug of abuse.

Marijuana addiction is also linked to a withdrawal syndrome similar to that of nicotine withdrawal, which can make it hard to quit. People trying to quit report irritability, sleeping difficulties, craving, and anxiety. They also show increased aggression on psychological tests, peaking approximately 1 week after they last used the drug.

How does marijuana use affect school, work, and social life?

Research has shown that marijuana's negative effects on attention, memory, and learning can last for days or weeks after the acute effects of the drug wear off. Consequently, someone who smokes marijuana daily may be functioning at a reduced intellectual level most or all of the time. Not surprisingly, evidence suggests that, compared with their nonsmoking peers, students who smoke marijuana tend to get lower grades and are more likely to drop out of high school. A meta-analysis of 48 relevant studies—one of the most thorough performed to date—found cannabis use to be associated consistently with reduced educational attainment (e.g., grades and chances of graduating). However, a causal relationship is not yet proven between cannabis use by young people and psychosocial harm.

That said, marijuana users themselves report poor outcomes on a variety of life satisfaction and achievement measures. One study compared current and former long-term heavy users of marijuana with a control group who reported smoking cannabis at least once in their lives but not more than 50 times. Despite similar education and income backgrounds, significant differences were found in educational attainment: fewer of the heavy users of cannabis completed college, and more had yearly household incomes of less than $30,000. When asked how marijuana affected their cognitive abilities, career

achievements, social lives, and physical and mental health, the majority of heavy cannabis users reported the drug's negative effects on all of these measures. In addition, several studies have linked workers' marijuana smoking with increased absences, tardiness, accidents, workers' compensation claims, and job turnover. For example, 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.

Does marijuana use affect driving?

Because marijuana impairs judgment and motor coordination and slows reaction time, an intoxicated person has an increased chance of being involved in and being responsible for an accident. According to the National Highway Traffic Safety Administration, drugs other than alcohol (e.g., marijuana and cocaine) are involved in about 18 percent of motor vehicle driver deaths. A recent survey found that 6.8 percent of drivers, mostly under age 35, who were involved in accidents tested positive for THC; alcohol levels above the legal limit were found in 21 percent of such drivers.