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Non-Medical Marijuana III: Rite of Passage or Russian Roulette?

A CASA* White Paper

June 2008

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Accompanying Statement by Joseph A. Califano, Jr., Chairman and President

In 1999, CASA published its first White Paper on non-medical marijuana, *Non-Medical Marijuana: Rite of Passage or Russian Roulette?*, spelling out the implications of legalization for children. In 2004, CASA issued its second White Paper on the subject, alerting parents to findings about the relationship between marijuana use and the increased risk of using other drugs. This White Paper, *Non-Medical Marijuana III: Rite of Passage or Russian Roulette?*, third in the series, is prompted by the alarming increases in the potency of marijuana, and in teen emergency department mentions, treatment admissions and clinical diagnoses of marijuana abuse and dependence.

All these reports focus on non-medical marijuana. Searching for the therapeutic potential of cannabis and addressing issues related to efficacy, safety, benefits and risks are appropriate. These are, however, matters for doctors, scientists, the National Institutes of Health, the Food and Drug Administration and pharmaceutical manufacturers rather than for public referenda. Efforts to decriminalize marijuana for medicinal purposes through popular referenda have politicized what should be a scientific process. To the extent that ingredients in marijuana possess properties that can efficaciously and safely relieve individuals suffering from AIDS or chemotherapy-related nausea, multiple sclerosis, or other ailments, the Food and Drug Administration can approve them for medical use.

We have written this report about non-medical marijuana to alert parents, teachers, doctors, clergy and all those who care about our nation's children, to critical and alarming findings about teen marijuana use:

- From 1992 to 2006, the potency of marijuana increased by 175.0 percent.

- From 1992 to 2006, there has been a 492.1 percent increase in the proportion of treatment admissions for persons under age 18 where clinical (DSM) diagnosis was reported for marijuana abuse or dependence, compared with a 53.7 percent *decline* in the proportion of DSM diagnoses for all other substances of abuse.*
- From 1992 to 2006, there has been a 188.1 percent increase in the proportion of treatment admissions for persons under age 18 who cite marijuana as their primary drug of abuse, compared with a 54.4 percent *decline* in the proportion of admissions for all other substances of abuse. This increase is driven, in part, by an increase in criminal justice referrals for treatment.
- From 1995 to 2002, the percentage of drug related emergency department findings for marijuana as a major substance of abuse among 12- to 17-year olds increased by 136.4 percent, more than five times the increase in findings for all other major substances of abuse (25.7 percent).[†]
- Many teens are using marijuana more intensely than in the past. Rates of daily marijuana use among 12th graders tripled from 1992 to 1999 and have stubbornly resisted significant change since then. In 2007, approximately 204,000 high school seniors (5.1 percent) used marijuana on a daily basis.
- Despite recent declines in teen marijuana use, in 2007 the percentage of teens who had ever used marijuana was 26.8 percent higher among 8th graders, 44.9 percent higher among 10th graders and 28.2 percent higher among 12th graders than lows in 1992. By 2007, a total of 10.7 million 9th to 12th graders had used marijuana.
- Marijuana is the second most frequently detected psychoactive substance among drivers (alcohol is the first) and is associated with impaired driving skills. It is associated more strongly with juvenile crime than alcohol use and is linked to poor academic performance.
- Marijuana use interferes with brain functions such as memory, learning and attention, can damage the lungs and heart and increase the risk of other drug use, and has been linked to other mental health problems in young people, such as depression, anxiety and conduct disorders.
- Recent research suggests possible associations between marijuana use and schizophrenia and other psychotic disorders.

The good news is that in recent years teen marijuana use and the percent of all teens who meet clinical criteria for marijuana abuse and dependence have declined. The bad news is that 10.7 million teens still report that they have used marijuana. The worst news is that for those who do use the drug there is growing cause for grave concern. The striking and parallel increases in marijuana's potency, in teen admissions to treatment for marijuana and in their diagnoses of marijuana abuse and dependence, and increases in emergency room findings linked to marijuana use together sound an alarm for parents and teens across the country. While not all teens who use marijuana will become addicted, experimentation is the first step to regular use. Regular marijuana use is a dangerous game of Russian roulette with the bullets of other drug use, addiction, interference with brain functioning, accidents, crime and health and social problems in the chamber.

Growing recognition of the dangers of marijuana use among teens has led Dr. Nora Volkow, Director of the National Institute on Drug Abuse, to state that "It is important to remind young people, their parents and others that marijuana is not a benign drug. Marijuana can be addictive; it interferes with critical brain functions, like learning and memory. And it may pose a threat to the health and well-being

* Includes alcohol, illicit, controlled prescription and over-the-counter drugs, and inhalants.

[†] Consistent estimates for trends are available only for the period from 1995-2002.

of children and adolescents at a critical point in their lives--when they are growing, learning, maturing, and laying the foundation for their adult years.”

The message for teens is clear: today’s pernicious pot is not your parents’ pot. The average THC levels in seized marijuana samples in the mid-1970s were less than one percent compared to 8.8 percent today. According to Florida’s Attorney General, “The increase in the drug’s potency also has caused marijuana’s market value to skyrocket. Hydroponic marijuana in some areas actually trades ounce for ounce with cocaine.”

Just as society came to understand the dangers of tobacco use and parents took action to protect their children and teens, it is now time to face the facts about marijuana use. Marijuana can be an addictive drug with enormous health and social consequences. Teens have easy access to the drug and begin use at early ages; the earlier they begin, the greater the likelihood that they will use other drugs and become dependent. It is of critical importance that parents take action to prevent marijuana use among their children and to help them stop using if they have already begun.

Parents take extraordinary efforts to protect their children and teens from known dangers. We make sure that toys, playgrounds and cribs are safe. We avoid exposure to lead paint. We vaccinate our children against disease. We equip our children with safety helmets to wear when rollerblading, skateboarding or riding their bikes. We make sure that our children and teens buckle up when they get in their cars. We educate our teens about the importance of abstinence and safe sex to prevent STDs. And now we educate and warn them against smoking, even if we were smokers ourselves. With the evidence now available, simple prudence requires parents to prevent their children from using marijuana. Those parents who fail to do so are uninformed or irresponsible, or both.

We as parents need to face the facts about marijuana use, recognize that there is now

compelling scientific evidence that was not available years ago and that the marijuana available to our children and teens is more dangerous as well. Parents are the most powerful prevention resource we have. But we need to take other action as well. Doctors, teachers, school officials, clergy and others who work with children and teens need to be alert to signs of marijuana use, intervene early and get help fast and, to educate the country about the dangers of teen marijuana use, we need a national public education campaign.

We can use our law enforcement system too. I am not suggesting that we put kids in jail the first time they get caught smoking marijuana. But why not treat a teen arrested for marijuana use much the same way we treat someone arrested for drunk driving when no injury occurs and require them to attend sessions to learn about the dangers of marijuana use and how to decline the next time they are offered a joint? Why not use the arrest as an opportunity and require kids cited for marijuana possession or other offenses where marijuana is involved to be screened for substance use and other psychological problems and referred for help if appropriate?

We owe it to our children to use all the powers we have to keep them safe.

We greatly appreciate the help of distinguished readers who contributed to the quality of this undertaking: Timothy P. Condon, PhD, Deputy Director of the National Institute on Drug Abuse, and Susan R. B. Weiss, PhD, Chief, Science Policy Branch; John Demers; and Alan I. Leshner, PhD, Chief Executive Officer of the American Association for the Advancement of Science. We also thank Deborah Trunzo, DASIS Team Leader, Office of Applied Studies, of the Substance Abuse and Mental Health Services Administration who reviewed our analysis of the Treatment Episode Data Set (TEDS).

Tamara Schlinger, Special Assistant for Public Policy, led the research effort. Roger Vaughan, DrPH, head of CASA’s Substance Abuse and Data Analysis Center (SADACSM), Clinical

Professor of Biostatistics, Department of Biostatistics, Mailman School of Public Health at Columbia University and associate editor for statistics and evaluation for the *American Journal of Public Health*, was responsible for the data analyses. He was assisted by Elizabeth Peters, Senior Data Analyst, SADACsm. Others who assisted include: David Man, PhD, MLS, CASA librarian and Jennie Hauser, bibliographic database manager. Susan E. Foster, CASA's Vice President and Director of Policy Research and Analysis, and I edited the paper. Jane Carlson handled the administrative responsibilities.

While many individuals and institutions contributed to this effort, the findings and opinions expressed herein are the sole responsibility of CASA.

Chapter I

Marijuana: The Teen Illicit Drug of Choice

Americans have watched optimistically as the percentage of young people who use marijuana has declined over the last few years; however, despite these decreases, use rates among young people remain substantially higher than they were at the low point in the early 1990s.¹ Teens report easy access to marijuana.² In 2007, 10.7 million 9th to 12th graders had used marijuana at some point in their lives and 204,000 high school seniors used it daily.*³

Trends in Teen Marijuana Use

Marijuana is the most commonly used illicit drug in the United States.⁴ For America's teens, marijuana use ranks just behind alcohol and tobacco as their drug of choice. By the time students are in their senior year in high school, 41.8 percent have used it.⁵ There have, however, been cycles in its popularity and use.

In the late 1960s and during the 1970s, marijuana use rose sharply among the youth population in the United States and crested by 1980. Use of marijuana by young people gradually declined throughout the 1980s and reached its lowest point in the early 1990s.⁶ In 1991, 31.3 percent of 9th to 12th graders had used the drug.[†] But then rates began to climb. The

* The *Monitoring the Future* study (MTF) and the *Youth Risk Behavior Survey* (YRBS). See Appendix B for survey descriptions. When reporting data for 8th, 10th and 12th graders individually, we use MTF; when reporting summary data on all 9th to 12th graders, we use YRBS because summary data are not available from MTF. MTF reports data annually, but YRBS reports data every other year. We have used a base year of 1991 for the YRBS, which is the year the survey began. The numbers of students were calculated by applying use rates from these surveys to population data presented in the October 2005 *Current Population Survey* conducted by the U.S. Census Bureau, the latest population data available. Daily marijuana use is defined for purposes of MTF as use on 20 or more occasions in the past 30 days.
[†] YRBS.

percentage of 9th to 12th graders using marijuana reached a high in 1999 of 47.2 percent before they again began to decline.⁷ By 2007, a total of 10.7 million 9th to 12th graders (38.1 percent) had used marijuana at some point in their lives.* Although the current prevalence rate remains below the recent peak, it is still 21.7 percent higher than in 1991.⁸ (Figure 1.A)

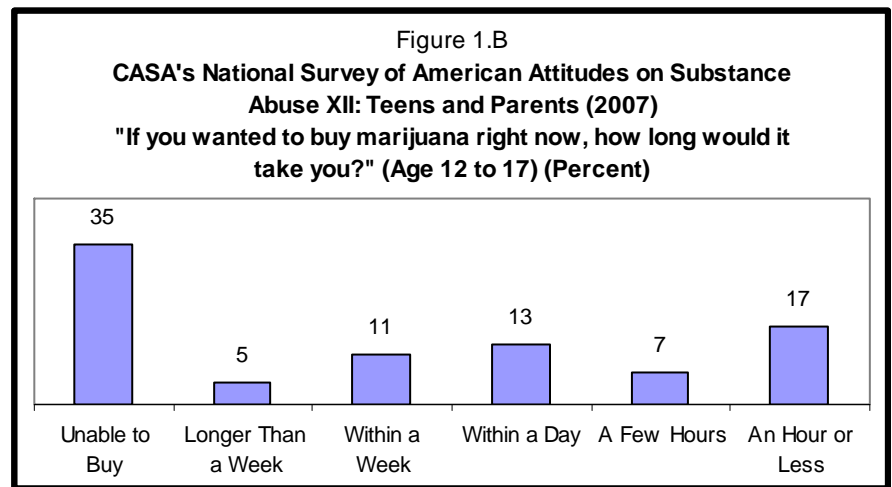
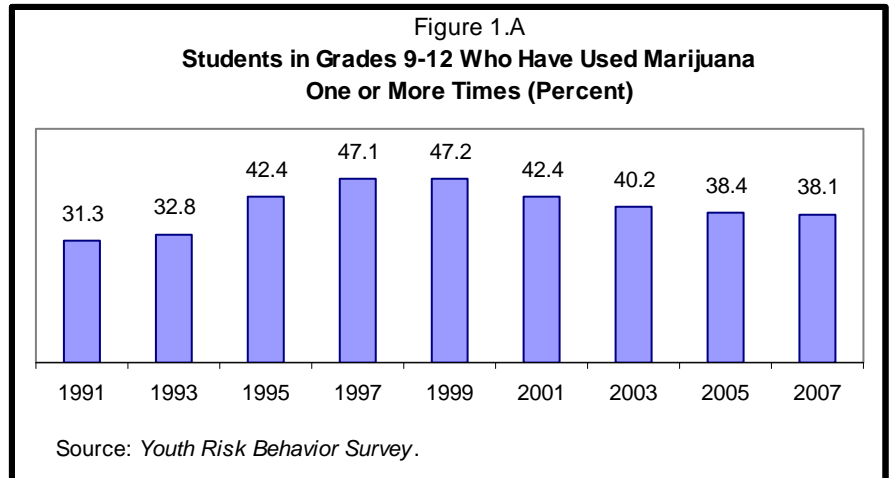
Teens Have Easy Access to Marijuana

In CASA's annual survey of American teens, 12- to 17-year olds report persistent ease in obtaining marijuana.⁹ An estimated 9.6 million 12- to 17-year olds (37 percent) reported in 2007 that they could buy marijuana within a day, and an estimated 4.4 million (17 percent) reported that they could buy it within an hour or less.^{† 10} (Figure 1.B)¹¹

If teens attend schools where they have witnessed drug use, sale or possession or have seen students high or drunk at school, they are four times likelier to say they can buy marijuana within a day than students who do not attend schools where they witness such events (57 percent vs. 14 percent), and are nearly six times likelier to say they can buy marijuana within an hour (28 percent vs. five percent).¹² (Figure 1.C)

* These numbers were calculated by applying use rates from YRBS to population data presented in the October 2005 *Current Population Survey* conducted by the U.S. Census Bureau, the latest population data available.

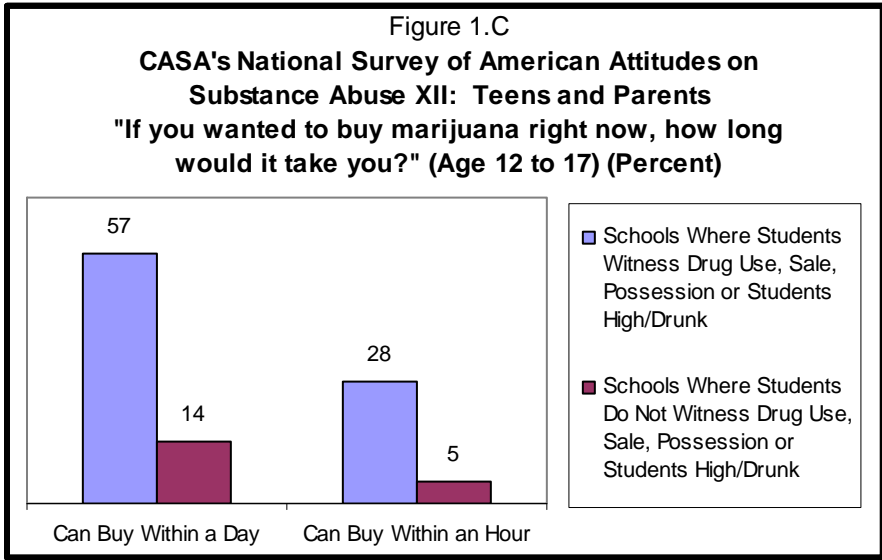
† CASA's 2007 *National Survey of American Attitudes on Substance Abuse XII: Teens and Parents*. See Appendix B for survey description. These numbers were calculated by applying use rates from CASA's 2007 Survey to population data presented in the October 2005 *Current Population Survey* conducted by the U.S. Census Bureau, the latest population data available.



An estimated 11 million high school students (80 percent) and an estimated five million middle school students (44 percent) attend such schools.¹³

[O]n any given day [in 2006] across our country for 12- to 17-year olds, we have...586,000 who are using marijuana.¹⁴

--Terry Cline, PhD, Administrator
SAMHSA



associated with an increased risk of using other drugs.¹⁸ Also, early initiation of the use of marijuana and other drugs has been associated with an increased risk for the development of substance abuse and dependence.¹⁹

Eighth Graders

More than 600,000 8th graders have tried marijuana; one in every seven or 14.2 percent. Approximately 243,000--one out of every 17 or 5.7 percent--has used it in the past month.[†] ²⁰ In 1992, 11.2 percent of 8th graders

had tried the drug. By 1996, use rates had risen to a high of 23.1 percent and then began to drop to current levels.²¹ However, the current rate of 14.2 percent remains 26.8 percent higher than in 1992.²² (Table 1.2)

In a hypothetical class of 30 8th grade students, four have tried marijuana and at least one has used it in the prior month.

Marijuana Use Starts Early

Most individuals who have used marijuana first tried the drug when they were teenagers, and teen users of the drug start at a very young age. Among youth aged 12 to 17 who have ever used marijuana, the mean age of initiation is 13.7, when they are likely to be in middle school. The mean age of initiation among individuals aged 18 to 25 who have tried marijuana is 15.9, when young people are likely high school freshmen or sophomores.^{*} ¹⁵ (Table 1.1)

Table 1.1
Average Age of First Use of Marijuana by Age Group²³

Age Group	Average Age of First Use
12-17	13.7
18-25	15.9

Source: CASA analysis of the *National Survey on Drug Use and Health* (NSDUH). (2006).

Tenth Graders

By 10th grade, almost one-third of all students (nearly 1.3 million or 31.0 percent) have tried marijuana. Approximately one out of every seven 10th graders (594,000 or 14.2 percent) has used it in the past month.[‡] ²⁴ In 1992, 21.4 percent had tried the drug. By 1997, use rates had risen to a high of 42.3 percent and then began to drop to current levels.²⁵ However, the current rate of 31.0 percent remains 44.9 percent higher than the low in 1992.²⁶ (Table 1.2)

Each year, at least 80,000 12- and 13-year olds use marijuana for the first time.¹⁶ In 2006 approximately 2.1 million people started using marijuana; approximately 1.3 million (63.3 percent) of them were under the age of 18.¹⁷ Early use is particularly troubling since the initiation of marijuana at a young age has been

[†] These numbers were calculated by applying use rates from MTF (2007) to population data presented in the October 2005 *Current Population Survey* conducted by the U.S. Census Bureau, the latest population data available.

[‡] These numbers were calculated by applying use rates from MTF (2007) to population data presented in the October 2005 *Current Population Survey* conducted by the U.S. Census Bureau, the latest population data available.

^{*} The *National Survey on Drug Use and Health* (NSDUH). See Appendix B for survey description.

High School Seniors

By the time teens reach their senior year in high school, nearly 1.7 million students have used marijuana; that is more than two in every five students or 41.8 percent. Approximately 753,000 or one out of every five (18.8 percent) have used it in the past month.^{* 27} In 1992, 32.6 percent had tried the drug.²⁸ By 1999, use rates had increased by 52.5 percent to virtually half of all 12th graders (49.7 percent) and then began a decline to current levels. However, the current rate of 41.8 percent remains 28.2 percent higher than the low in 1992.²⁹ (Table 1.2)

Intensity of Use

Between 1992 and 1999, there was a disturbing increase in daily marijuana use[†] among teens. Rates of daily use tripled among 12th graders (1.9 percent vs. 6.0 percent).³⁰ While rates of lifetime, annual and monthly marijuana use began a downward trend from the highs in the mid to late 1990s, rates of daily use have shown no significant changes since 1997. In 2007, approximately 204,000 high school seniors (one in 20 or 5.1 percent) used marijuana on a daily basis.³¹

Table 1.2
Lifetime Marijuana Use
Among 8th, 10th and 12th Graders, 1992 – 2007 (by percent)

Grade	1992	1994	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
8 th	11.2	16.7	23.1	22.6	22.2	22.0	20.3	20.4	19.2	17.5	16.3	16.5	15.7	14.2
10 th	21.4	30.4	39.8	42.3	39.6	40.9	40.3	40.1	38.7	36.4	35.1	34.1	31.8	31.0
12 th	32.6	38.2	44.9	49.6	49.1	49.7	48.8	49.0	47.8	46.1	45.7	44.8	42.3	41.8

Source: *Monitoring the Future Study*.

* These numbers were calculated by applying use rates from MTF (2007) to population data presented in the October 2005 *Current Population Survey* conducted by the U.S. Census Bureau, the latest population data available.

† Daily marijuana use is defined for purposes of MTF as use on 20 or more occasions in the past 30 days.

Chapter II

Marijuana Potency: Not Your Mother's Marijuana

Marijuana that was in circulation in the 1960s was composed of marijuana seeds and a great deal of large leaves, twigs and other material that today would be regarded as waste.³² However, the potency of marijuana has been increasing dramatically as evidenced by testing of seized samples.³³

What Is Marijuana?

Marijuana consists of dry, shredded flowers, stems, seeds and leaves from the hemp plant *Cannabis sativa*.³⁴ A variety of psychoactive preparations are derived from hemp. The preparations, also called cannabis, include marijuana, hashish (a more concentrated, resinous form), hash oil (a tar-like liquid) and sinsemilla (made from the buds and flowering tops of female plants).³⁵

Marijuana usually is smoked as rolled cigarettes (joints), in pipes or in water pipes (bongs), or may be mixed in foods.³⁶ Marijuana also may be smoked in blunts made by removing the tobacco from cigars and refilling them with marijuana or marijuana combined with another drug, such as crack cocaine.³⁷

THC (delta-9-tetrahydrocannabinol) is the primary psychoactive ingredient in marijuana.³⁸ It is responsible for initiating cellular reactions that lead to the high experienced by marijuana use.³⁹

How Potent Is It?

The amount of THC determines the potency of the drug,⁴⁰ and the average potency level of marijuana has been increasing steadily.⁴¹ The University of Mississippi Potency Monitoring Project, which is funded by the National Institute on Drug Abuse, began monitoring marijuana THC levels in the mid-1970s. The Potency Monitoring Project analyzes THC levels in samples confiscated by law enforcement

agencies.⁴² In the mid-1970s, the average THC levels of seized marijuana were less than one percent.⁴³ By 1985, the average amount of THC in seized samples in the United States had risen to 3.5 percent and between 1992 and 2006 THC content increased by 175 percent to 8.8 percent.*⁴⁴ (Figure 2.A) As reported by the Office of National Drug Control Policy, the Potency Monitoring Project has found concentrations of THC in its marijuana sampling of over 32 percent.⁴⁵

The Source of Non-Medical Marijuana

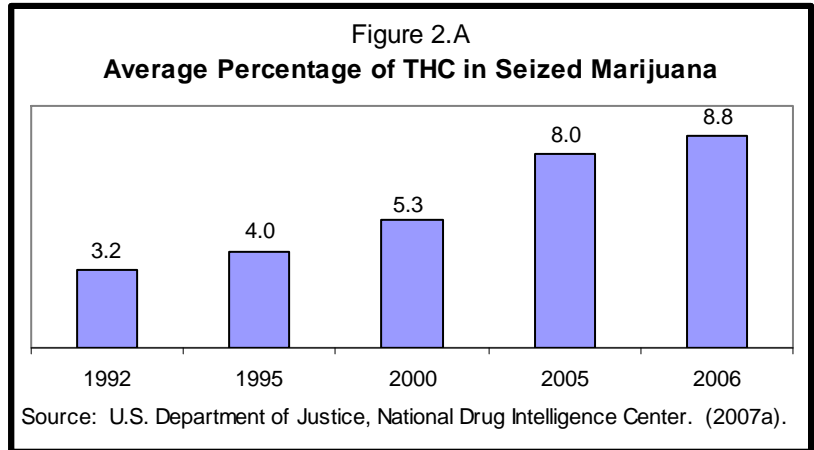
Although a large amount of the marijuana available in the United States continues to come from Mexico,⁴⁸ the 2008 *National Drug Threat Assessment* (NDTA) reports a rising prevalence in domestic drug markets of high-potency marijuana produced within the United States and Canada. The NDTA also reports a 36.6 percent increase in cannabis cultivation in Mexico between 2001 and 2005, and a 17.5 percent increase in seizures between U.S. and Canadian ports of entry between 2001 and 2006.⁴⁹

*A global blind-spot has developed around cannabis, and in this murk the plant itself has been transformed into something far more potent than in the past.... Most of the cannabis smoked in the 1960s would be considered to be of low quality today.*⁴⁶

--United Nations Office on Drugs and Crime
2006 World Drug Report

* For the sake of consistency, the percentages of THC content in marijuana provided in this White Paper, including Figure 2.A, have been rounded to one decimal place. The percentages as reported by the 2008 *National Drug Threat Assessment* (citing the University of Mississippi Potency Monitoring Project) are as follows: 3.48 (1985), 3.16 (1992), 3.96 (1995), 5.34 (2000), 8.02 (2005), 8.77 (2006). (U.S. Department of Justice, National Drug Intelligence Center, 2007a).

† This involves a process of growing the plants in a nutrient laden solution as opposed to conventional soil.



Law enforcement officials in the United States and Canada have discovered instances of drug traffickers smuggling cocaine from California north along the Interstate 5 corridor to Canada in exchange for “BC Bud,”⁵⁰ a potent strain of marijuana that has been reported to have a THC content of up to 30 percent.⁵¹ Many marijuana users now prefer high-potency marijuana.⁵²

*The increase in the drug’s potency also has caused marijuana’s market value to skyrocket. Hydroponic† marijuana in some areas actually trades ounce for ounce with cocaine.*⁴⁷

--Bill McCollum
Florida Attorney General

There also has been a sharp increase in domestic production of marijuana since 2000, as more drug trafficking organizations have been relocating their operations from Mexico and Canada to the United States. These operations are being moved to domestic locations to reduce risk of seizure at the borders, to gain greater access to local markets and to increase profit margins. Increased indoor domestic marijuana cultivation is being driven by growers’ attempts to avoid outdoor eradication efforts, produce higher potency marijuana and reduce risk of detection.⁵³

The more potent forms of marijuana are grown using advanced equipment and cultivation methods,⁵⁴ and they command a higher retail price.⁵⁵ The NDTA reports a sharp increase in indoor cultivation in the U.S.⁵⁶ The top seven states for marijuana cultivation are California, Hawaii, Kentucky, Oregon, Tennessee, Washington and West Virginia.⁵⁷ Marijuana can be big business in these states and others. For example, in 2005 more than 135,000 marijuana plants were seized in Washington State. The estimated value of these seized plants was \$270 million, reportedly making the crop among the state's top 10 agricultural commodities.⁵⁸

The Internet and movies provide a modern medium for information about marijuana. Movies that feature pot as a major component of their theme are becoming increasingly popular. Web sites providing information about growing and using marijuana are readily available. For example, a simple online search using the terms "how to grow marijuana" returns more than 350,000 hits. All of the search returns do not contain information about how to grow marijuana and some are cautionary sites, but this provides a sense of the enormous amount of information available on this topic. The Internet also has become a resource for information about purchasing marijuana. For example, a Connecticut man was accused recently of placing an ad for the sale of marijuana on craigslist.org, a popular Web site that provides classified ads and forums online for 450 cities worldwide.⁵⁹

Back in the '80s, directors snuck pot-smoking scenes into movies like 9 to 5 and The Breakfast Club--and some of those scenes have become iconic. By the '90s, pot comedies were riding high.... After 2000, Hollywood's interest in stoner themes and characters only increased.⁶⁰

Chapter III

Marijuana Use Driving Dependence and Treatment

Marijuana can be an addictive drug.⁶¹ Rates of teen admissions to treatment for marijuana as the primary drug of abuse have increased by 188.1 percent between 1992 and 2006, compared with a 54.4 percent *decline* in rates of teen admissions for all other substances combined.*⁶² Rates of reported clinical diagnosis of marijuana abuse and dependence for those under age 18 admitted to treatment increased by 492.1 percent in the same period, compared with a 53.7 percent *decline* in rates of clinical diagnoses for all other substances combined.⁶³ These sharp increases in teen treatment admissions and clinical diagnoses of abuse and dependence parallel sharp increases in marijuana's potency.

*There is no question marijuana can be addictive; that argument is over.... The most important thing right now is to understand the vulnerability of young, developing brains to these increased concentrations of cannabis.*⁶⁴

--Nora D. Volkow, MD, Director
National Institute on Drug Abuse

Marijuana and the Brain

When an individual smokes marijuana, THC, the main psychoactive ingredient, moves quickly from the lungs into the bloodstream to other organs, including the brain. THC acts by binding to cannabinoid receptors in the brain, over-stimulating them and disrupting normal function. This over-stimulation produces the intoxicating effects that marijuana users experience.⁶⁵

In addition to the intoxicating effects, marijuana affects the areas of the brain that are important for learning and memory (the hippocampus); body movement, control and coordination (the cerebellum and the basal ganglia); higher cognitive functions (the cerebral cortex); and

* Includes alcohol, illicit, controlled prescription and over-the-counter drugs, and inhalants.

reward (the nucleus accumbens). (See Appendix A, Marijuana's Effects on the Brain) During intoxication, the impact of marijuana on these and other areas of the brain can result in impairments in short-term memory, attention, judgment, coordination and balance and altered perception of time. Other effects can include hunger, thirst, intensification of colors and sound, the feeling of a dry mouth and, in some instances, anxiety, panic and distrust.⁶⁶

When marijuana is smoked, THC is absorbed by the lungs and arrives in the brain within minutes.⁶⁷ The effects of the drug begin immediately after it enters the brain and generally last from one to three hours. If the drug is consumed in food or drink, its effects begin more slowly (usually one-half to one hour later) and last longer (generally up to four hours).⁶⁸

Because the brain is still developing during adolescence and into the 20s,⁶⁹ there is growing concern that the developing brains of young people are particularly susceptible to the harms of marijuana and other licit and illicit drugs. Contrary to the long-held notions that the brain is fully developed by the end of childhood, research has shown that adolescence is a period of profound brain modification and refinement. Key areas of the brain--particularly the prefrontal cortex, which is responsible for functions including impulse control, planning, decision-making and allocating attention--are not fully mature until an individual is into his or her 20s.⁷⁰ The prefrontal cortex, as well as the hippocampus and cerebellum, are "strongly implicated in the cognitive impairments associated with chronic cannabis use."⁷¹

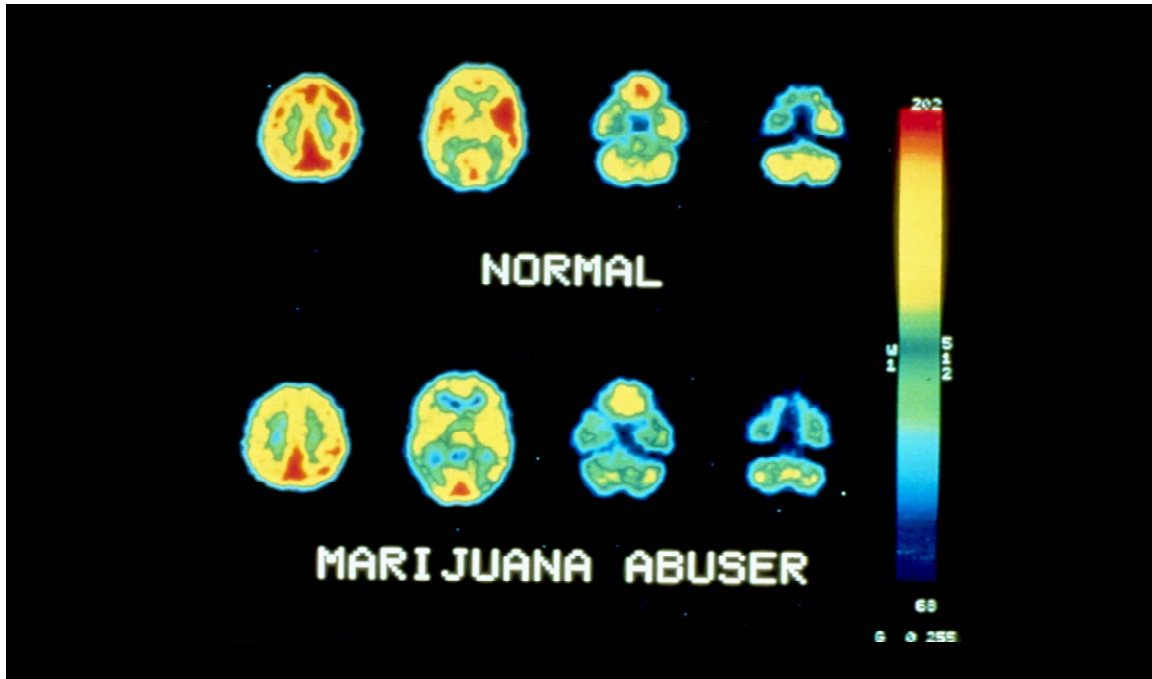
Research about the effects of marijuana on the developing brain is in its early stages; however, one study found that individuals who start using marijuana before age 17 may later experience deficits in visual scanning tasks.⁷² A study of a small group of abstinent adolescent cannabis users found that they had "deficits in sustained attention and performed a working memory task less accurately than controls."⁷³

Some research has found that long-term heavy marijuana use may cause cognitive impairments, particularly with respect to memory and attention, which can last up to a day or two after smoking marijuana.⁷⁴ One study found that adverse cognitive effects in very heavy marijuana users were still present 28-days post-abstinence.⁷⁵ Cognitive impairments may worsen with increasing years of regular use.⁷⁶ Also, studies have demonstrated that "chronic marijuana use is associated with alterations in brain networks . . . responsible for some higher level cognitive processes."⁷⁷

Figure 3.A shows the impact on brain activity of chronic marijuana use. Four brain images are shown for each subject. The lower set of images is from the marijuana abuser, who was still an active user of the drug but had not used marijuana for four days at the time of the scan. The last two images for each subject are taken at levels of the brain where the cerebellum is located, which is responsible for coordination of voluntary motor movement, balance and equilibrium, and muscle tone and is also involved in learning. The colors represent the levels of metabolism on a declining scale from red to blue. When compared with the control, the marijuana abuser shows lower amounts of metabolism. These findings are consistent with observed defects in motor coordination among chronic marijuana users.⁷⁸

Research shows that marijuana-induced disruption in normal functioning of brain receptors along with other changes in the brain can lead to addiction, including withdrawal symptoms.⁷⁹

Figure 3.A



Source: PET slide and related information from the files of Nora D. Volkow, M.D., Director of the National Institute on Drug Abuse. This information is associated with results previously presented in Volkow, N. D., Gillespie, H., Mullani, N., Tancredi, L., Grant, C., Valentine, A., et al. (1996).

[D]evelopment of a cannabis dependence syndrome characterized by a loss of control over cannabis use is likely in chronic users.⁸⁰

--World Health Organization

Marijuana Drives Treatment Admissions for Teens

Research indicates that the earlier drug use is initiated, the higher the risk for abuse and dependence.⁸¹ In 2006, for adults 21 and older who first tried marijuana at age 14 or younger, 10.4 percent were classified with illicit drug abuse or dependence compared to 2.0 percent of adults who had first used marijuana at age 18 or older.⁸²

The early use of more potent marijuana may be driving admissions for treatment of marijuana abuse. In 2006, 82.3 percent of admissions in individuals under age 18 reported marijuana use at the time of admission.* This is compared with 56.1 percent of those under age 18 who reported alcohol use--the most commonly used

* *Treatment Episode Data Set (TEDS)*. See Appendix B for description.

drug among teens--at the time of admission for treatment.⁸³

Sixty-five (65.4) percent of treatment admissions involving children and teens under the age of 18 cite marijuana as their primary substance of abuse, more than three times the rate for alcohol (20.0 percent). The rate of treatment admissions among children and teens under age 18 for marijuana as the primary substance of abuse (65.4 percent) is more than twice the rate for all other substances combined (30.4 percent).⁸⁴ (Table 3.1)

Table 3.1
Treatment Admissions by Primary Substance of Abuse Under Age 18, 2006⁸⁵
 (by percent)

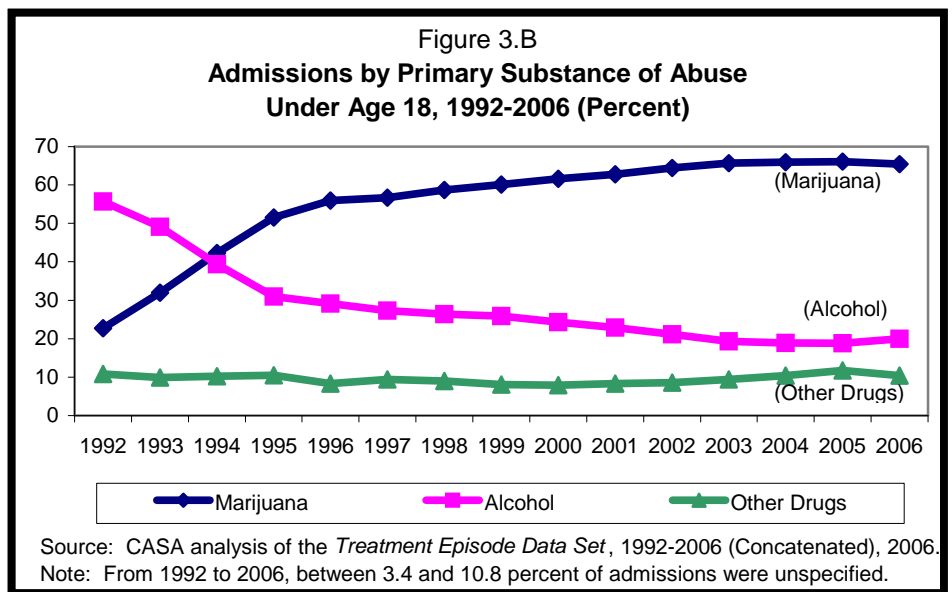
	2006
Marijuana/Hashish	65.4
Alcohol	20.0
Other Drugs	10.4
Unspecified	4.3

Source: CASA analysis of the *Treatment Episode Data Set* (TEDS). (2006).

This picture has changed dramatically over the past 15 years as the percentage of admissions for children and teens under age 18 for marijuana as the primary substance of abuse has surged. From 1992 to 2006, rates of admission for children and teens under age 18 for marijuana as the primary substance of abuse increased by 188.1 percent from 22.7 percent to 65.4 percent, compared with a 54.4 percent *decline* in rates of admission for all other substances combined. During this same period, the percentage of admissions for alcohol as the primary substance of abuse dropped by nearly two-thirds (64.1 percent) while rates of admission for all other drugs of abuse remained steady.⁸⁶ (Figure 3.B)

Increased treatment admissions for teens have been driven, in part, by referrals from the criminal justice system. Between 1992 and 2006, the proportion of criminal justice referrals for those under age 18 where marijuana is the primary substance of abuse increased by 34.4 percent (40.1 vs. 53.9). This is compared with a 23 percent decline from 1992 to 2006 in the proportion of referrals from all other sources (59.9 percent vs. 46.1 percent) including self-referral, schools and other sources.⁸⁷

Although some have argued that the increased treatment rates for marijuana abuse are simply artifacts of more drug courts and other court-ordered treatment,⁸⁸ workplace drug testing and promotional activities of the treatment industry,⁸⁹ experiences from abroad reveal an increase in treatment admissions that appear to be relatively unrelated to these factors. In the Netherlands, for example, where personal use of cannabis and some retail sales of the drug have been decriminalized, there was an increase in the number of individuals seeking treatment for cannabis use between 1994 and 2001. Also, in Australia, where work-place drug testing is not common and there has not been a large private treatment program industry for cannabis dependence, the proportion of users seeking treatment increased by 425 percent between 1990 and 2001 (four percent vs. 21 percent).⁹⁰ These experiences suggest that other factors--



such as the increased potency of the drug--may be helping to drive these increases in treatment admissions for marijuana abuse and dependence. Further, findings of more recent research are changing perceptions of the addictive nature of marijuana, which may be reflected in treatment admissions.

Increase in Clinical Diagnoses of Teen Marijuana Abuse and Dependence

Also bolstering the proposition that increasing potency may, in part, be driving treatment admissions is the rise in the reported percentage of treatment admissions for children and teens under the age of 18 that meet medical criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) for diagnosis of marijuana abuse or dependence.* Although self-reports of

* The *Diagnostic and Statistical Manual of Mental Disorders –Fourth Edition* (DSM-IV-TR), which is published by the American Psychiatric Association, is the main diagnostic reference of mental health professionals in the United States. DSM-IV-TR recognizes substance dependence and abuse, including cannabis dependence and abuse. The criteria for substance dependence set forth in the DSM-IV-TR are “a maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by three (or more) of the following, occurring any time in the same 12-month period:” tolerance; withdrawal; substance often taken in larger amounts over longer period than intended; persistent desire or unsuccessful effort to cut down or control use; great deal of time spent to obtain or use the substance, or recover from its effects; give up important social, occupational, or recreational activities because of substance use; and continued substance use despite knowledge of a persistent or recurrent physical or psychological problem caused or exacerbated by the substance. The DSM-IV-TR defines substance abuse as “a maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by one (or more) of the following, occurring within a 12-month period”: recurrent substance use resulting in failure to fulfill major role obligations at work, school or home; recurrent substance use in situations where it is physically hazardous; recurrent substance-related legal problems; continued substance use despite having

teens from the National Survey on Drug Use and Health show that the percentage of 12- to 17-year olds in the general population who meet criteria for marijuana abuse or dependence has declined since 2002,† the reported percentage of teen treatment admissions that meet medical criteria for abuse or dependence has skyrocketed. In 2006, 36.8 percent of treatment admissions for persons under the age of 18 included a clinical (DSM) diagnosis; of those, 52.7 percent met such criteria for marijuana abuse and dependence, compared with 16.3 percent that met clinical criteria for abuse or dependence on alcohol and 13.1 percent that met such criteria relevant to other drugs.⁹² (Table 3.2)

Table 3.2
**Reported* Treatment Admissions
Receiving DSM Diagnosis Under Age 18: 2006⁹¹
(by percent)**

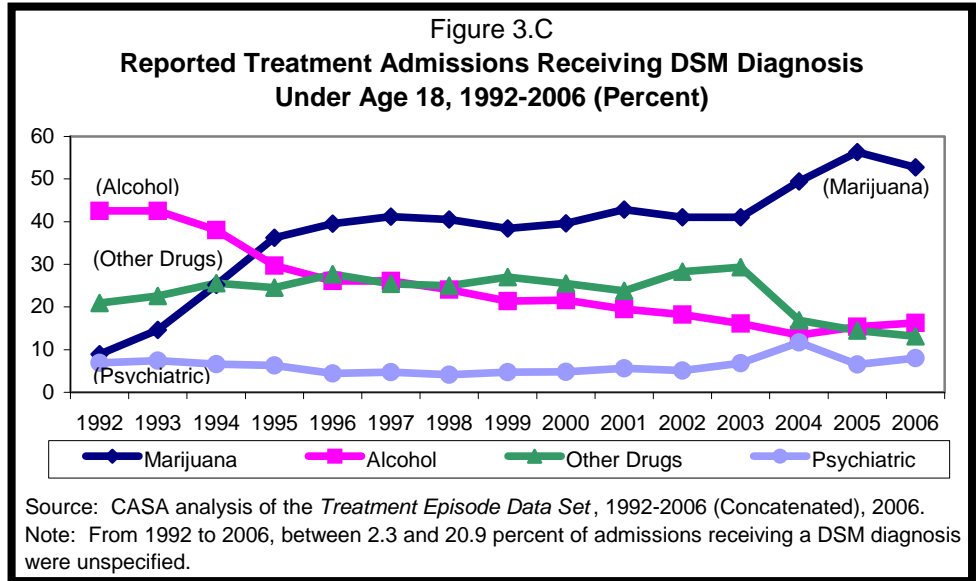
	2006
Marijuana	52.7
Alcohol	16.3
Other Drugs	13.1
Psychiatric	8.0
Unspecified	10.0

* In 2006, a DSM diagnosis was reported for 36.8 percent of admissions.
Source: CASA analysis of the *Treatment Episode Data Set* (TEDS). (2006).

persistent or recurrent social or interpersonal problems caused by the effects of the substance. (American Psychiatric Association, 2000).

† According to the NSDUH, the percentage of 12- to 17-year olds meeting criteria for substance abuse or dependence in the past year between 2002 and 2006 are as follows: 4.3 (2002); 3.8 (2003); 3.9 (2004); 3.6 (2005); 3.4 (2006). (U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Office of Applied Studies, 2003, 2005, 2007d). Because of changes made to NSDUH methodology, time series data are available only from 2002 to the present.

Following the rise in rates of treatment admissions for children and teens under the age of 18 has been a 492.1 percent increase between 1992 and 2006 in the reported percentage of admissions that meet clinical criteria for marijuana abuse or dependence (8.9 to 52.7 percent), compared with a 53.7 percent decline in the proportion that meet clinical criteria for all other substances combined.* At the same time, the percentage of admissions that met the medical criteria for alcohol abuse, dependence or intoxication declined by 61.6 percent from 42.5 percent to 16.3 percent, and the percentage that met similar criteria for other drugs of abuse declined as well.⁹³ (Figure 3.C)



Although withdrawal is included in the DSM-IV-TR among the possible symptoms of substance dependence, a specific cannabis withdrawal syndrome is not included. Research provides evidence of a cannabis withdrawal syndrome,^{† 94} and such evidence has led

* In 1994, a new version of the DSM was introduced. Between 1992 and 2006, the percentage of all records for admission of persons under the age of 18 that included information on clinical (DSM) diagnosis increased from 26.8 to 36.8 percent, with a high of 41.0 percent in 2004. Although there was a 37.3 percent increase in the percentage of admissions of those under age 18 that met clinical criteria for any substance of abuse, there was a 492.1 percent increase in the reported percentage that met criteria for marijuana abuse or dependence. (The National Center on Addiction and Substance Abuse (CASA) at Columbia University, 2008f). If the overall increase in diagnosis assignment were the main contributing factor, then rates for other DSM categories would have been expected to increase; however, DSM rates for alcohol, other drugs, and other DSM categories declined over this same period, while DSM rates for marijuana and psychiatric disorders increased.

† Earlier research shed light on marijuana's potential for physical addiction and withdrawal. Researchers found that rats subjected to immediate cannabis

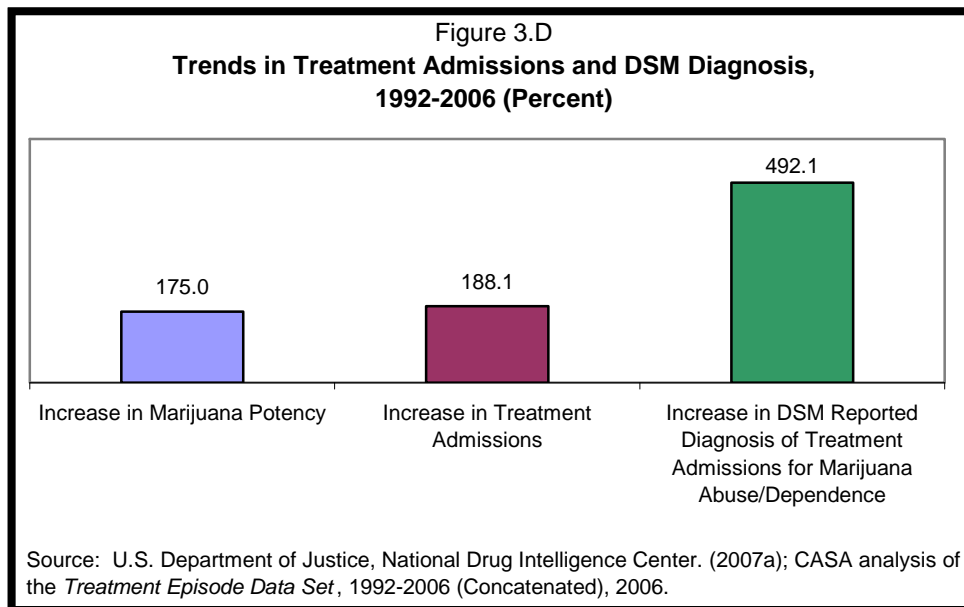
researchers to call for the next revision of the DSM to include a cannabis withdrawal syndrome.⁹⁵ Symptoms of withdrawal include anxiety, decreased appetite/weight loss, irritability, restlessness, sleep, strange dreams, anger and aggression, depressed mood, physical discomfort, stomach pain, sweating, shakiness, chills and increased craving for marijuana.⁹⁶ A recent study, involving heavy daily users of cannabis and tobacco found that withdrawal discomfort and symptom severity during cannabis abstinence was similar to that observed among cigarette smokers during tobacco abstinence. The study noted that many individuals seeking outpatient treatment for cannabis dependence experience great difficulty achieving initial periods of abstinence, indicate that withdrawal contributes to an inability to quit, and report using cannabis and other substances to alleviate the symptoms of

withdrawal exhibited changes in behavior similar to those seen after withdrawal of cocaine, alcohol and opiates. (de Fonseca, F.R., Carrera, M.R.A., Navarro, M., Koob, G.F., & Weiss, F., 1997). By demonstrating that long-term cannabis use produces changes in the brain similar to those seen after use of other major drugs of abuse, the researchers found "the first neurochemical basis for a marijuana withdrawal syndrome, and one with a strong emotional component that it shared by other abused drugs." (Wickelgren, I., 1997).

withdrawal.⁹⁷ In a recently reported study of 469 heavy cannabis users, one-third of the participants reported that, after making a serious attempt to quit using the drug, they resumed use because of withdrawal symptoms.⁹⁸

Use + Potency = Trouble

The increases in potency and rates of treatment admission and clinical diagnosis of marijuana abuse and dependence paint a dramatic and disturbing picture, particularly in light of recent declines in teen marijuana use. Rates of marijuana use remain 29.8 percent higher for 12th graders in 2006 than they were at the low point in 1992, and are almost 48.6 percent higher for 10th graders and 40.2 percent higher for 8th graders.^{* 99} During this same period, the potency of seized marijuana increased by an average 175.0 percent,¹⁰⁰ rates of admission to treatment for marijuana abuse increased by 188.1 percent and the percentage of admissions to treatment programs of teens meeting reported clinical criteria for marijuana abuse or dependence increased by 492.1 percent.¹⁰¹ (Figure 3.D)



* 2006 MTF data are used here for purposes of comparison with available data on potency and treatment admissions.

Chapter IV

Health Consequences of Marijuana Use

Just as rates of teen treatment admissions and related clinical diagnoses of marijuana abuse and dependence have risen dramatically, paralleling increases in drug potency, so too have teen marijuana-related health emergencies. At the same time, advances in medical research are improving our understanding of the deleterious impact of marijuana use on the respiratory system, the heart and on fetal development, and revealing complex associations between marijuana use and mental illness.

Marijuana-Related Medical Emergencies

In 2005,^{*} marijuana was second only to cocaine as the most frequently mentioned illicit substance in emergency department (ED) visits that involved an illicit drug.¹⁰² In that year, 16 percent of the visits that involved marijuana were made by 12- to 17-year olds.¹⁰³

Between 1995 and 2002,[†] the percentage of total drug-related ED mentions for marijuana as a major substance of abuse among 12- to 17-year olds increased by 136.4 percent, more than five times the increase in mentions for all other major substances of abuse combined (25.7 percent).¹⁰⁴

^{*} Latest data available from the *Drug Abuse Warning Network Survey (DAWN)*. See Appendix B for survey description.

[†] While DAWN in some form has existed since the 1970s, it was not until 1994 that a single agency (SAMHSA) took over its management and implemented a constant methodological approach. Consistent reporting and “final estimates” for trends are provided by SAMHSA/DAWN for the period now called “old DAWN” from 1995-2002. Changes made to DAWN in 2003 preclude direct comparison of the data for 1995 through 2002 with data for 2004 and 2005.

The Respiratory System

Marijuana and tobacco smoke contain similar levels of tar but the smoke of marijuana contains up to 50 percent more carcinogens and results in greater tar deposits in the lungs when compared to filtered tobacco cigarettes. Although marijuana users tend to smoke less material per day than tobacco smokers, they smoke unfiltered material, inhale deeper and hold the smoke longer in their lungs than tobacco smokers.¹⁰⁵

Marijuana smoking can cause some of the same types of respiratory damage in chronic users as those caused by tobacco smoking.¹⁰⁶ Long-term use has been associated with an increased risk of respiratory complications such as an increase in cough, sputum production and wheeze.¹⁰⁷ Chest tightness, large airways obstruction and hyperinflation also may be associated with long-term cannabis use. A recent study found that one joint of cannabis had a similar effect in terms of airflow obstruction of up to five tobacco cigarettes.¹⁰⁸

One study that assessed the impact of marijuana and tobacco smoking on respiratory health found that individuals with more than 100 lifetime episodes of marijuana use and at least one day of use in the past month was associated with an increased risk for chronic bronchitis,¹⁰⁹ which can be debilitating and can increase the risk of additional infections.¹¹⁰ These users also were at increased risk of production of phlegm, coughing on most days, wheezing and chest sounds in the absence of a cold.¹¹¹ Marijuana may increase the risk of respiratory exposure to infectious organisms since cannabis plants are a source of fungal spores.¹¹²

The Heart

Marijuana causes an increase in heart rate,¹¹³ which generally starts while the marijuana is being smoked and lasts approximately two to three hours, and an increase in the volume of blood pumped by the heart.¹¹⁴ The cardiovascular effects of marijuana, while not generally associated with serious health problems for users who are young and healthy,

can be a problem for older, less healthy users. As reported in *Non-Medical Marijuana II*, one study found that within one hour after smoking marijuana, the risk of a heart attack increased nearly five-fold compared to periods of non-use of marijuana.¹¹⁵

Pre-Natal Exposure

Some limited research conducted on prenatal exposure to marijuana has shown such exposure to be associated with problems such as deficits in memory¹¹⁶ and sustained attention,¹¹⁷ and poorer performance in tasks requiring visual analysis and reasoning¹¹⁸ at certain stages during childhood. Response inhibition and impulsivity may be affected by prenatal marijuana exposure as well.¹¹⁹ One study found prenatal exposure to be associated with an earlier onset of marijuana use in children as well as more frequent use at age 14.¹²⁰

Mental Illness

Recent research has found a relationship between cannabis use and psychotic disorders including schizophrenia,¹²¹ particularly in vulnerable individuals.¹²² A review of the evidence pertaining to cannabis and psychoactive mental health outcomes “found a consistent increase in incidence of psychosis outcomes in people who had used cannabis.” It found an increase in the risk of psychosis of approximately 40 percent in participants who had ever used cannabis and noted that most studies showed a 50 percent to 200 percent increase in risk of psychosis for those who used most heavily. “[T]here is now enough evidence,” the study concluded, “to inform people that using cannabis could increase their risk of developing a psychotic illness later in life.”¹²³ Some research also has found that cannabis use may exacerbate symptoms of such disorders¹²⁴ and contribute to relapse.¹²⁵ The review of cannabis and psychoactive mental health outcomes along with other research led *Lancet*, the noted British medical journal, to retreat from a 1995 editorial statement that the “smoking of cannabis, even long term, is not harmful to health.”¹²⁶ In 2007, *Lancet* noted

that research published since 1995, including a systematic review that *Lancet* published on cannabis and mental health, “leads us now to conclude that cannabis use could increase the risk of psychotic illness.”¹²⁷

*Evidence that cannabis use can cause serious mental illness is mounting.*¹³²

--United Nations Office on Drugs and Crime

Some research suggests an association between frequent marijuana use and depression¹²⁹ but evidence on the nature and strength of the association is mixed.¹³⁰

Increasing evidence indicates that the co-occurrence of substance abuse and other mental health problems in young people “is the norm, not the exception.” In a clinical trial involving 600 adolescents (between the ages of 12 and 18) who met the criteria for a clinical diagnosis of cannabis abuse or dependence and had used cannabis in the past 90 days, 88 percent of the participants met the criteria for conduct disorder, Attention-Deficit Hyperactivity Disorder (ADHD), depression, anxiety, disorders of traumatic stress or some combination of these syndromes at an acute level.* Three-fourths of the adolescents had severe levels of conduct disorder (74 percent) or ADHD (77 percent). Thirty-seven percent of the sample evidenced

*There are serious mental health consequences associated with cannabis, including a significant risk of dependency, precipitation and aggravation of psychosis, and acute dysphoric episodes. These risks appear to be higher for people who start consuming cannabis during adolescence....Cannabis is not the harmless herb often portrayed, but a psychoactive drug that deserves to be taken seriously.*¹³³

--United Nations Office on Drugs and Crime
2006 World Drug Report

* In the study cited, DSM-IV criteria were used to diagnose marijuana use disorders and a symptom checklist was used to measure symptoms of five syndromes (conduct disorder, ADHD, depression, anxiety and disorders of traumatic stress).

severe levels of depression and 28 percent had severe levels of anxiety.¹³¹

Available research cannot yet confirm whether there is a causal relationship between marijuana use and other mental health problems, whether marijuana use precedes or follows the development of certain mental health issues, or whether there are other factors at play (such as the presence of environmental factors or genetic predisposition) which may increase the risk for one or both.

*I don't think you have to be overly concerned. It's normal. Most kids try it.... That's when they try it. There's only so much we can do.*¹²⁸

--David Sheff

Father and author of *Beautiful Boy*, describing the advice that he received from his 12-year old son's teacher after discovering that his son, who later spiraled into a world of addiction on methamphetamine, was smoking pot.

Increased Risk of Other Drug Use

There is a strong association between marijuana use and the subsequent use of other illicit drugs.¹³⁴ For example, most cocaine users have already used marijuana,¹³⁵ and people who use marijuana are at a higher risk of using other illegal drugs.¹³⁶ Many theories have been advanced as to why this pattern occurs, ranging from genetic factors,¹³⁷ to brain changes resulting from drug exposure, to individual learning processes or differential association of cannabis users and non-users with the drug culture and market.¹³⁸ While the causal mechanisms are still unclear, the association between the use of marijuana and the use of other drugs has been well established.¹³⁹

As reported in *Non-Medical Marijuana II*, CASA established a statistical relationship between current use of marijuana--in and of itself--and the later use of drugs such as cocaine, heroin, methamphetamines, LSD and Ecstasy.¹⁴⁰ CASA conducted a special analysis of data from the 2001 U.S. Centers for Disease Control and

Prevention's *Youth Risk Behavior Survey* of 11,000 9th through 12th graders, and isolated teen use of these drugs from other problem behaviors such as fighting, drunk driving, carrying a weapon and attempting suicide. The findings indicated that, among teens aged 12 to 17 with no other problem behaviors, those who used marijuana at least once in the past 30 days are 13 times likelier than those teens who have not used marijuana in the past 30 days (33.5 percent vs. 4.4 percent) to use another drug like cocaine, heroin, methamphetamines, LSD or Ecstasy, and almost 26 times likelier than those teens who have never used marijuana (33.5 percent vs. 1.3 percent) to use another drug like cocaine, heroin, methamphetamines, LSD or Ecstasy.¹⁴¹

Most illicit drug users begin their illicit drug use with marijuana; their use of this drug usually is preceded by the use of alcohol and nicotine.¹⁴² Data gathered as part of the *Christchurch Health and Development Study*,* found that "the increasing use of cannabis was associated with the increasing use, abuse/dependence and diversity of use of other forms of illicit drugs."¹⁴³

Another recent study of 219 same-sex Dutch twin pairs, confirmed the associations between marijuana use and the subsequent use of other drugs. The study found that when compared to their co-twin who did not start using marijuana prior to age 18, young people who initiated marijuana use before the age of 18 had a heightened risk for the subsequent use of other drugs. According to the study, 5.1 to 6.4 percent of individuals who used marijuana prior to age 18 reported regular use of other drugs while none of their co-twins reported such use. By using the co-twin methodology, the study was able to control for common familial risk factors that may predispose individuals to early marijuana use as well as the later use of other illicit drugs.^{† 144}

* The *Christchurch Health and Development Study* is a longitudinal study of a birth cohort of 1,265 children born in New Zealand (Christchurch regions) in 1977.

† A parallel study of same-sex twin pairs from Australia was reported in *Non-Medical Marijuana II*.

(Lynskey, M. T., Heath, A. C., Bucholz, K. K., Slutske, W. S., Madden, P. A. F., Nelson, E. C., Statham, D. J., & Martin, N. G., 2003).

Chapter V

Marijuana Use, Crime and Academic Problems

Marijuana use among children and teens is associated with serious social problems, including impaired driving skills, juvenile offenses and crimes and poor academic performance.

Drugged Driving

Data from road traffic arrests and fatalities show that marijuana is the second-most frequently detected psychoactive substance among drivers (alcohol is the first).¹⁴⁵ In a study of motor vehicle crash victims admitted to a Maryland trauma center, more than half of the drivers tested positive for recent drug use, with more than one in four testing positive for marijuana use.* The highest prevalence of marijuana use was among drivers 16- to 20-years old.¹⁴⁶

Marijuana has been found to impair driving performance on open and closed driving courses and on driving simulator tasks. Some of the effects include: an increase in reaction times, a decrease in car handling performance, impaired ability to estimate time and distance, subjective sleepiness, lateral travel, impaired motor coordination and impaired sustained attention to driving.¹⁴⁷

*Kids just don't see it as all that risky....We've done a great job on educating young people and parents about the dangers of drinking and driving....We need to ramp up our efforts on drugging and driving.*¹⁴⁸

--Stephen Wallace
Chairman and Chief Executive Officer
Students Against Destructive Decisions

In a publication based on deliberations of the *International Consultative Panel on Drugs and Driving Impairments*, the National Highway and Traffic Safety Administration reports that low

* More than one-third of these individuals also tested positive for alcohol.

doses of THC have been shown to moderately impair the tasks associated with driving, while high doses as well as chronic use produce severe impairment.¹⁴⁹ One study found that habitual use of marijuana was associated with a 10-fold increase in the risk of car crash injury or death.¹⁵⁰ Another study conducted in France found that the risk of being responsible for a fatal crash while driving under the influence of cannabis increases with the amount consumed.¹⁵¹

Driving under the influence of marijuana, alcohol, or any other drug is a public health risk as it not only endangers the driver but also others on the road. The problems connected with driving under the influence may be intensified when dealing with young drivers who have less experience and have a higher risk of accident involvement when compared to more experienced drivers.¹⁵²

Other Juvenile Offenses

Marijuana use is strongly associated with juvenile crime. In 2006, youth who had ever been arrested and booked for breaking the law were four times likelier than those who were never arrested to have used marijuana in the past year (44 percent vs. 11 percent). Youth who had ever been arrested and booked for breaking the law were twice as likely than those who were never arrested to have used alcohol in the past year (63 percent vs. 31 percent), and three times likelier to have used any illicit drug except marijuana (33 percent vs. 11 percent).¹⁵³

As reported in CASA's study *Criminal Neglect: Substance Abuse, Juvenile Justice and The Children Left Behind*, juveniles who use marijuana are likelier than those who do not to be arrested and to be arrested repeatedly. The earlier an individual begins to use marijuana, the likelier he or she is to be arrested; 21.6 percent of individuals who had first used marijuana at age 11 or younger were arrested in the past year compared with 5.7 percent of those who had begun marijuana use at age 18 or older and 2.1 percent of those who had never used marijuana.¹⁵⁴

Academic Problems

Marijuana use by teens is linked to academic problems. Early educational successes and failures can influence the probability of drug use, including marijuana use.¹⁵⁶

*It is important to remind young people, their parents and others that marijuana is not a benign drug. Marijuana can be addictive; it interferes with critical brain functions, like learning and memory. And it may pose a threat to the health and well-being of children and adolescents at a critical point in their lives--when they are growing, learning, maturing, and laying the foundation for their adult years.*¹⁵⁵

--Nora D. Volkow, MD, Director
National Institute on Drug Abuse

Among 12- to 17-year olds enrolled in school in the past year (based on 2005 data), students with higher grade averages were less likely to have used marijuana in the past month than students with lower averages. Among 12- to 17-year olds who were full-time students in the month before the survey, students who skipped school were nearly four times as likely as those who did not to have used marijuana in the past month.¹⁵⁷

According to a study that assessed students from schools in California and Oregon,* those who abstained from using marijuana and other illicit drugs reported less involvement in deviant behaviour (e.g., such as skipping school, theft, violence, drug selling drugs, property damage, disorderly conduct, running away) at grade 12 compared to students who had experimented

* These adolescents were participants in the RAND Adolescent/Young Adult Panel Study, which was conducted to evaluate the effectiveness of the Project ALERT drug use prevention program.

with marijuana or were frequent users.* The abstainers reported higher parental support, better grades and greater time devoted to homework and extracurricular activities. The abstainers had higher college graduation rates by age 23 and were less involved in deviant behaviour (e.g. stealing, selling drugs, engaging in predatory violence). The study authors concluded that marijuana experimentation is a “risk factor or marker for poorer functioning on several dimensions during the transition to young adulthood.”¹⁵⁸ Other research has found that substance use is one of the key health problems that has been associated with dropping out of school.¹⁵⁹

A study on marijuana use during adolescence and young adulthood found that those who abstained from marijuana use had greater life satisfaction, higher educational achievement, better overall health and the lowest rates of use of other illicit drugs by age 29 when compared to participants in the study who used marijuana.^{† 160}

* Abstainers were defined as those individuals who had never tried marijuana or any other illicit drug. Individuals who had used marijuana, but less than 10 times in the past year and less than three times in the past month, were considered experimenters. Frequent users were those individuals who had used marijuana three or more times in the past month and had also tried at least one other illicit drug.

† These individuals were also participants in the *RAND Adolescent/Young Adult Panel Study*.

Chapter VI

Conclusion

This White Paper underscores the urgency of addressing the dangers associated with non-medical marijuana use, particularly for our children and teens. Current evidence is more than sufficient to demonstrate that marijuana does not just provide a harmless high; it is an increasingly dangerous game of Russian roulette. Simple prudence should compel parents, school administrators, teachers, coaches, counselors, doctors, clergy, law enforcement and all others concerned with the health and welfare of our youth to take action now to prevent marijuana use among our children and teens. To educate the country about the dangers of teen marijuana use, the national government and the public health community should mount a major public education campaign.

Appendix A

Marijuana's Effects on the Brain

Marijuana's Effects on the Brain ¹⁶¹		
	Brain Region	Functions Associated With Region
	Brain regions in which cannabinoid receptors are abundant	
	Cerebellum	Body movement coordination
	Hippocampus	Learning and memory
	Cerebral cortex, especially cingulate, frontal, and parietal regions	Higher cognitive functions
	Nucleus accumbens	Reward
	Basal ganglia <ul style="list-style-type: none"> • Substantia nigra pars reticulata • Entopeduncular nucleus • Globus pallidus • Putamen 	Movement control
	Brain regions in which cannabinoid receptors are moderately concentrated	
	Hypothalamus	Body housekeeping functions (body temperature regulation, salt and water balance, reproductive function)
	Amygdala	Emotional response, fear
Spinal cord	Peripheral sensation, including pain	
Brain stem	Sleep and arousal, temperature regulation, motor control	
Central gray	Analgesia	
Nucleus of the solitary tract	Visceral sensation, nausea and vomiting	

Appendix B

Data Sources

CASA's Teen Survey

Since 1995, CASA has conducted the *National Survey of American Attitudes on Substance Abuse*, a series of national surveys of teens' attitudes toward substance abuse as well as the attitudes of those who most influence them-- parents, teachers and school principals. Other surveys seek to measure the extent of substance use in the population; CASA's survey probes substance abuse risk. The purpose of the survey is to identify factors that increase or diminish the likelihood that teens will use cigarettes, alcohol or illegal drugs in an effort to develop the most effective means of helping teens avoid substance abuse. CASA's 2007 survey included 1,063 adolescents and teens aged 12 to 17 (554 boys, 509 girls).

Drug Abuse Warning Network

The *Drug Abuse Warning Network* (DAWN) public health surveillance system is conducted by the Substance Abuse and Mental Health Services Administration. DAWN monitors drug-related emergency department (ED) visits from the United States and for selected metropolitan areas. Its estimates pertain to the entire United States. DAWN relies upon a national sample of general, non-Federal hospitals that operated 24-hour EDs. The DAWN sample is national in scope, with oversampling of hospitals in selected metropolitan areas. In participating hospitals, ED medical records are reviewed retrospectively to find the ED visits related to recent drug use. Illegal drugs, prescription and over-the-counter pharmaceuticals, dietary supplements, and non-pharmaceutical inhalants are included. Alcohol, when present in combination with another drug, is included for patients of all ages. When it is the only drug implicated in a visit, alcohol is included for patients younger than age 21. DAWN estimates for 2005 were based on data submitted by 355 hospitals. DAWN estimates

for 2004 and 2005 are based on a new, redesigned sample of hospitals. Therefore, estimates for 2004 and 2005 cannot be compared with earlier years.¹⁶²

Monitoring the Future

The *Monitoring the Future* study (MTF) is funded by the National Institute on Drug Abuse. MTF is an ongoing survey conducted by the University of Michigan's Institute for Social Research of the behaviors, attitudes and values of American secondary school students, college students and young adults. Each year, a total of approximately 50,000 8th, 10th and 12th grade students are surveyed. The survey is administered in schools, providing increased confidentiality, but does not include young people who are absent when the surveys are conducted or who have dropped out of school. More than 540,000 public school students dropped out of grades 9-12 in the 2004-2005 school year.^{* 163} This survey provides data on 12th graders since 1975, and 8th and 10th graders since 1991.

National Survey on Drug Use and Health

The *National Survey on Drug Use and Health* (NSDUH)[†] is administered by the Substance Abuse and Mental Health Services Administration. The NSDUH is a cross-sectional national survey of approximately 70,000 randomly selected non-institutionalized individuals aged 12 and older in the United States. It is known to under-estimate considerably all forms of substance use in the U.S. particularly among young people because it is administered in the home where a parent or other adult is present, leading respondents--particularly teens--to under-report their substance use. Moreover, the survey does not

* The District of Columbia and Oregon did not report dropout data for the 2004-2005 school year. The Bureau of Indian Education and the Department of Defense do not participate in the data collection. Also, data related to private schools are not included.

† Formerly known as the *National Household Survey on Drug Abuse*.

include high-risk institutionalized populations, such as prison inmates, hospital patients, nursing home residents, patients in drug abuse treatment and others who cannot be reached in a home (e.g., the homeless). Because of changes made in survey methodology, time series data are available only from 2002 to the present.

Youth Risk Behavior Survey

The *Youth Risk Behavior Survey* (YRBS) is administered by the Centers for Disease Control and Prevention. The YRBS is a national school-based survey that monitors six categories of priority health-risk behaviors among youth and young adults, including tobacco, alcohol and other drug use. The survey also is administered in schools, offering increased confidentiality, and does not include young people who are absent when the surveys are conducted or who have dropped out of school. The survey provides data from 1991-2007; approximately 14,000 students were surveyed in 2007.

Treatment Episode Data Set

The *Treatment Episode Data Set* (TEDS) is sponsored by the Substance Abuse and Mental Health Services Administration. TEDS provides information on the demographic and substance abuse characteristics of the approximately 1.8 million annual admissions to treatment for abuse of alcohol and drugs in facilities that report to individual state administrative data systems. TEDS does not include all admissions to substance abuse treatment. Rather, it includes admissions to facilities that are licensed or certified by the state substance abuse agency to provide substance abuse treatment (or are administratively tracked by the agency for other reasons). Facilities reporting TEDS data are generally those that receive state alcohol and/or drug agency funds (including Federal Block Grant funds) for the provision of alcohol and/or drug treatment services. Also, TEDS is an admission-based system, and TEDS admissions do not represent individuals. Thus, an individual admitted to treatment twice within a calendar year would be counted as two admissions.¹⁶⁴

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