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United Nations Office on Drugs and Crime

Cannabis
A Short Review

Discussion Paper

Cannabis: A Short Review

Cannabis: Its Use, Functions, and Prevalence

Cannabis, produced from the Cannabis sativa plant, is used in three forms: herbal cannabis, the dried leaves and flowering tops, also known as 'cannabis,' ganja,' or 'weed,' among others; cannabis resin, the pressed secretions of the plant, known as 'hashish' or 'charash;' and cannabis oil, a mixture resulting from distillation or extraction of active ingredients of the plant.Herbal cannabis is the cannabis product used most frequently in much of the world, while cannabis resin is primarily used in Europe.Cannabis oil is less widely used, accounting for only 0.05% of cannabis seizures in 2009.[1]

Cannabis is produced in nearly every country worldwide, and is the most widely produced illicit drug.The highest levels of cannabis herb production – approximately 25% of global production – take place in Africa, particularly in Morocco, South Africa, Lesotho, Swaziland, Malawi, Nigeria, Ghana, Senegal, Gambia, Kenya, and Tanzania.North and South America follow, each responsible for 23% of worldwide production of cannabis herb.Indoor production of cannabis herb is rising, as there is a lower chance of detection and growers are able to harvest multiple times per year, and is concentrated in North America, Europe, and Oceana. Cannabis herb remains the most trafficked illicit drug in the world in terms of volume and geographic spread.North America accounts for 70% of global seizures, particularly concentrated in Mexico and the United States, followed by Africa (11%) and South America (10%). Cannabis resin is second to cannabis herb in terms of volume of trafficking.Afghanistan has recently emerged as a major producer of cannabis resin, overtaking Morocco in terms of volume, and cannabis has become a competitor to opium poppy as a lucrative crop for farmers.Nearly all cannabis resin seizures (95%) took place in Europe, the Middle East, Southwest Asia, and North Africa. [1, 2, 3]

In addition to production, cannabis use is highest among illicit drugs globally.In many countries, cannabis use increased during the 1990s and early 2000s, but is now generally stabilizing or even decreasing.Rates of use, however, are not low; it is estimated that between 125 and 203 million people – between 2.8% and 4.5% of the world population aged 15-64 –used cannabis at least once during the past year in 2009.Though use in North America has remained relatively stable, use in the United States has increased slightly over the past four years.Annual prevalence of cannabis use in North America is approximately 10.7% of the population aged 15-64, and youth use has risen over the past four years.[4]In Mexico, use of the drug remains low, at approximately 1% of the population, though there are indications cannabis use is

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[1] UNODC, Cannabis in Africa: An Overview, 2007
[2] UNODC, World Drug Report, 2010
[3] UNODC, The Cannabis Market, 2011
[4]SAMHSA, National Household Survey on Drug Use and Health, 2011; NIDA, Monitoring the Future, Dec. 2010.

rising.[5]Africa has the third highest cannabis prevalence rate in the world, after the Oceania region and North America, with estimates ranging from 21.6 to 59.1 million users, or 3.8% to 10.4% of the population. These estimates have been calculated on the basis of a very limited number of household surveys and the extrapolation of results from a few school surveys. The broad range reflects the high level of uncertainty and the general lack of reliable information pertaining to drug use throughout the continent.Oceana has a high prevalence of cannabis use as well, with information primarily available from Australia and New Zealand.Australia has recently experienced a slight increase in overall cannabis use, following strong declines over the 1998-2007 period.[6]Cannabis use in the Caribbean and South and Central America are steady and lower than North America, Africa, and Oceana. Countries in Western and Central Europe report decreasing use of the drug, while use in Eastern European nations is increasing; use throughout all of Europe is particularly concentrated among young people, aged 15-24, 13.9% of whom report using cannabis annually.Some countries, like England and Wales, have experienced strong declines in cannabis use in recent years.[7]Prevalence of cannabis use in Asia is low – between 1.2% and 2.5% of the population aged 15-64 (31 to 68 million people); however, estimates for the world's most populated countries estimates are either unavailable (China) or only partially available and outdated(for men in India in 2000).[1, 2, 3]

Cannabis in the Brain and Body

The active ingredient in cannabis, delta-9-tetrahydrocannabinol (THC), is only found in small portions of the cannabis plant, in the flowering tops and in some of the leaves.THC stimulates cannabinoid receptors (CBRs), located on the surface of neurons, to produce psychoactive effects.CBRs are part of the endocannabinoid system, a communication network in the brain that plays a role in neural development and function.CBRs are typically activated by a naturally occurring neurotransmitter, anandamide.THC mimics anandamide, binding with the CBRs and activating the neurons, but the effects of THC are more potent and longer acting than the endogenous neurotransmitter.CBRs are widely distributed in the brain, but are particularly prevalent in the hippocampus, cerebellum, prefrontal cortex, and amygdala – brain regions involved in pleasure, cognition, concentration, memory, reward, pain perception, and motor coordination.[8]CBR receptor activation regulates the release of multiple neurotransmitters, including noradrenaline, GABA, serotonin, and dopamine.[9]Animal studies have indicated that THC exposure increases the

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[5] Villatoro, V. J. A. et al. (2009). Student survey of Mexico City 2006: Prevalence and trends of drug use. *Salud Ment* [online]. vol.32, n.4, pp. 287-297. Accessed November 2011 at http://www.scielo.org.mx/scielo.php?pid=S0185-33252009000400004&script=sci_abstract&tlng=en

[6]AIHW, 2010 National Drug Strategy Household Survey report, Canberra, July 2011 and National Drug Strategy, *Marijuana in Australia: Patterns and Attitudes,* Monograph Series No. 31, Canberra 1997

[7]UNODC estimates based on UK Home Office, *British Crime Survey* 2010/11 and previous years, UNODC, Annual Reports Questionnaire Data, EMCDDA, Statistical Bulletin 2011

[8] NIDA, Research Report Series: Cannabis Abuse, 2010

[9] Moreira, F. A & Lutz, B. (2008). The endocannabinoid system: Emotion, learning, and addiction.*Addiction Biology, 13:*196-212.

release of noradrenaline, causing anxiety-like behavior in rodents.The rewarding effects of cannabis may be due to an increase of serotonin, while GABA is responsible for memory deficits promoted by THC, as well as stress.[10]

While some users may consume cannabis in food or beverages, cannabis is typically smoked in a water pipe or joint (sometimes with added tobacco, usually depending on geographic region), as it is the fastest way for the drug to reach the brain and produce the desired effects.THC passes from the lungs into the bloodstream, and is carried up into the brain, creating the effects almost instantly. Smoked cannabis produces a high that lasts from one to three hours, and delivers significantly more THC into the bloodstream than eating or drinking the drug. A few minutes after smoking cannabis, heart rate increases and in some cases doubles, the bronchial passages relax and become enlarged, and the eyes become red as the blood vessels expand.While the behavioral effects of cannabis depend on the dose received, potency, mode of administration, the user's previous experience with the drug, and the setting (e.g., the social setting, user's expectations, or mood state), users typically report the feeling of euphoria and relaxation.As those effects subside, some users report feeling sleepy or depressed, and others may feel anxious or panicked, or have paranoid thoughts or experience acute psychosis depending on pharmacogenetic characteristics and vulnerability (more on the psychosis link in subsequent sections). [11, 12]

Cannabis use is linked to deficits in tasks of executive functioning.It has negative effects on memory, including the ability to form new memories, and on attention and learning.In a laboratory setting, cannabis and THC produce dose-related deficits in reaction time, attention, motor performance and coordination, and information processing. These effects can last up to 28 days after abstinence from the drug.[13]

Functional imaging studies have found lower activity levels in regions of the brain involved in memory and attention, such as the hippocampus, prefrontal cortex, and cerebellum in chronic cannabis users.Heavy, chronic users may have reduced volumes of the hippocampus and amygdala.[12]Additionally, adults who use cannabis heavily often exhibit deficits in executive functioning, attention, learning, and memory within a few days following use.[14]

While THC is the main psychoactive component in cannabis extracts, cannabis contains at least 489 chemical constituents, 70 of which are cannabinoids.While many of these components have not been isolated, two, cannabinol and

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[10] Maldonado, R., Berrendero, F., Ozaita, A., & Robeldo, P. (2011). Neurochemical basis of cannabis addiction.*Neuroscience, 181:*1-17.

[11] NIDA, Research Report Series: Cannabis Abuse, 2010

[12] Hall W & Degenhard L (2009). Adverse health effects of non-medical cannabis use.*Lancet, 374*:1383-1391.

[13] Hall W & Degenhard L (2009). Adverse health effects of non-medical cannabis use.*Lancet, 374*:1383-1391.

[14] Schweinsburg AD, Brown, SA, & Tapert, SF (2008).The influence of cannabis use on neurocognitive functioning in adolescents.*Current Drug Abuse Reviews, 1*:99-111.

cannabichromene have slight THC-like effects.Additionally, cannabis contains varying quantities of cannabinoid carboxylic acids, which lack psychoactive effects until they are heated (during cooking or smoking), when they transform into an active form of THC.Cannabidiol (CBD), while abundant, lacks the psychoactive effects of the others, but contributes to anti-inflammatory responses.[15, 16]

Science confirms that the adolescent brain, particularly the prefrontal cortex, is not fully developed until the early to mid-20s, with research indicating that developing brains are much more susceptible to all of the negative effects of marijuana and other drug use.[17]

Cannabis and Driving

In the past decade, researchers from all corners of the world have documented the problem of cannabis use and driving.[18,19,20,21,22,23]Linked to neurological deficits, including the impairment of motor coordination and reaction time, cannabis use can increase the risk of road accidents in drivers who are under the influence.[24]Cannabis remains the second most cited drug after alcohol in car crashes. In a major nationally-representative U.S. sample found that more than 8 percent of weekend, nighttime drivers tested positive for cannabis, nearly four times of the percentage of drivers with the U.S. legal limit for alcohol while driving [e.g. Blood Alcohol Content (BAC) of .08 or more].[25] Crancer and Crancer found that there were 126 fatalities in single-car crashes with cannabis-involved drivers, three-quarters of whom had BAC levels below the legal limit of 0.08.[26]In a study of seriously injured drivers admitted

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[15]Maldonado, R., Berrendero, F., Ozaita, A., & Robeldo, P. (2011). Neurochemical basis of cannabis addiction.*Neuroscience, 181:*1-17.

[16] Fi□ar, Z. (2009). Phytocannabinoids and endocannabinoids. *Current Drug Abuse Reviews, 2*:51-75.

[17] Giedd. J. N. (2004). Structural magnetic resonance imaging of the adolescent brain. *Annals of the New York Academy of Sciences*, *1021*, 77-85. And see

[18] Drummer, O.H., Gerostamoulos, J., Batziris, H., Chu, M., Caplehorn, J.R., Robertson, M.D., Swann, P. (2003). The incidence of drugs in drivers killed in Australian road traffic crashes. *Forensic Science International, 134*(2-3), 154-162.

[19] European Monitoring Centre for Drugs and Drug Addiction. (2003) Drugs and driving: ELDD comparative study. Lisbon, Portugal: Author. Retrieved March 29, 2011 from http://www.emcdda.europa.eu/attachements.cfm/att_5738_EN_Quantities.pdf

[20] Mørland J. (2000) Driving under the influence of non-alcoholic drugs, *Forensic Science Review, 12,* 80-105.

[21] ROSITA Roadside Testing Assessment: www.rosita.org

[22] DRUID: www.druid-project.eu

[23] Verstraete, A.G. & Raes, E. (Eds.). (2006). Rosita-2 Project Final Report. Ghent Belgium: Ghent University.

[24] For a comprehensive review, see DuPont, R. et al.(2010).
Drugged Driving Research: A White Paper. Prepared for the National Institute on Drug Abuse. Accessed November 2011 at http://stopdruggeddriving.org/pdfs/DruggedDrivingAWhitePaper.pdf

[25] Compton, R., & Berning, A. (2009). Results of the 2007 National Roadside Survey of Alcohol and Drug Use by Drivers. Traffic Safety Facts Research Note (DOT HS 811 175). Washington, DC: National Highway Traffic Safety Administration.

[26] Crancer, A. and Crancer, A.(2011). The Involvement of Cannabis in California Fatal Motor Vehicle Crashes. 1998–2008, June 2010. Accessed November 2011 at http://druggeddriving.org/pdfs/CAMJStudyJune2010.pdf

to a Level-1 shock trauma center, more than a quarter of all drivers tested positive for cannabis.[27]

Perhaps the most robust evidence linking cannabis use and driving comes from a meta-analysis of nine studies conducted by researchers at Columbia University's College of Physicians and Surgeons. After reviewing these epidemiologic studies from the past twenty years, they found that cannabis use was linked to heightened risk of crash involvement, even when controlling for multiple different variables. Furthermore, they found that the risk of crash involvement increased along with an increase in cannabis potency (tested through urinalysis) and self-reported frequency of use. The researchers commented that "the results of this meta-analysis suggest that cannabis use by drivers is associated with a significantly increased risk of being involved in motor vehicle crashes."[28]

Research conducted at the University of Auckland, New Zealand also showed that cannabis use and auto crashes are strongly linked. The research found that habitual cannabis users were 9.5 times more likely to be involved in crashes, with 5.6% of people who had crashed having taken the drug, compared to 0.5% of the control group.[29]Though research has revealed a cannabis and impaired driving link, it remains a difficult policy challenge.[24]

Cannabis and Addiction

Long-term cannabis use can lead to tolerance to the effects of THC, as well as addiction. Cannabis dependence is the most common type of drug dependence in many parts of the world, including the United States, Canada, and Australia, after tobacco and alcohol.It is estimated that 1 in 9 cannabis users overall will become dependent.Those who begin using the drug in their teens have approximately a one in six risk of developing dependence.[30]Users who try to quit experience withdrawal symptoms that include irritability, anxiety, insomnia, appetite disturbance, and depression. [4, 5] A United States study that dissected the National Longitudinal Alcohol Epidemiologic Survey (conducted from 1991 to 1992 with 42,862 participants) and the National Epidemiologic Survey on Alcohol and Related Conditions (conducted from 2001 through 2002 with more than 43,000 participants) found that the number of cannabis users stayed the same while the number dependent on the drug rose 20 percent - from 2.2 million to 3 million.[31] Authors speculated that higher potency cannabis, discussed below, may have been to blame for this increase. Additionally,

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[27] Romano, E, & Voas, R. B. (2011). Drug and Alcohol Involvement in Four Types of Fatal Crashes; Journal of Studies on Alcohol and Drugs, June 2011.

[28] Li, M., Brady, J., DiMaggio, C., Lusardi, R., Tzong, K. and Li, G. (in press). Cannabis use and motor vehicle crashes. *Epidemiologic Reviews*.

[29] Blows, S. et al. (2005).Cannabis Use and Car Crash Injury. *Addiction,* Vol 100, April 2005

[30] Wagner, F.A. & Anthony, J.C. From first drug use to drug dependence; developmental periods of risk for dependence upon cannabis, cocaine, and alcohol. *Neuropsychopharmacology* 26, 479-488 (2002).

[31]Compton, W., Grant, B., Colliver, J., Glantz, M., Stinson, F. Prevalence of Cannabis Use Disorders in the United States: 1991-1992 and 2001-2002*Journal of the American Medical Association.*. 291:2114-2121.

data from the National Institute on Drug Abuse found that in the United States of America in 1993 cannabis comprised approximately 8% of all treatment admissions, but by 2009 that number had increased to 18%.[32]In Western and Central Europe, cannabis is a significant public health concern; it has been reported as the primary drug of abuse of 21% of cases in treatment, and 14% of cases in Eastern and Southeast Europe.Further, among users ages 15-19, 83% of patients undergoing drug treatment primarily use cannabis.[33]

Young people are especially susceptible to cannabis addiction. Research from treatment centers in the United States indicates that the earlier drug use is initiated, the higher the risk for abuse and dependence. In 2006, 10 percent of adults 21 and older who first tried cannabis at age 14 or younger were classified with illicit drug abuse or dependence compared to 2 percent of adults who had first used cannabis at age 18 or older. The early use of more potent cannabis may be driving admissions for treatment of cannabis abuse. In 2006, 82 percent of admissions in individuals under age 18 reported cannabis use at the time of admission. This is compared with 56 percent of those under age 18 who were admitted for alcohol use.[34] Indeed, more than two-thirds of treatment admissions involving those under the age of 18 cite cannabis as their primary substance of abuse, more than three times the rate for alcohol and more than twice for all other drugs combined.This data also revealed that from 1992 to 2006, rates of admission for children and teens under age 18 for cannabis as the primary substance of abuse increased by 188 percent while other drugs remained steady.[35]

Data in the United States is corroborated with data from other countries. In the European Union, the percentage of cannabis as the primary reason for entering treatment increased by 200 percent from 1999 to 2006, and currently stands at around 30 percent of all admissions.[36]

High-Potency Cannabis

THC content and the potency of cannabis have been increasing over the past 30 years, which may cause users to develop heightened responses to the drug, as well as adverse effects.Higher THC content can increase anxiety, depression, and

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[32] Substance Abuse and Mental Health Services Administration. (2009). Office of Applied Studies. *Treatment Episode Data Set (TEDS): 2009 Discharges from Substance Abuse Treatment Services*, DASIS.

[33] UNODC, *The Cannabis Market*, 2011.

[34] Substance Abuse and Mental Health Services Administration. (2009). Office of Applied Studies. *Treatment Episode Data Set (TEDS): 2009 Discharges from Substance Abuse Treatment Services*, DASIS.

[35] Substance Abuse and Mental Health Services Administration. (2009). Office of Applied Studies. *Treatment Episode Data Set (TEDS): 2009 Discharges from Substance Abuse Treatment Services*, DASIS.

Also see Non-medical cannabis: Rite of passage or Russian roulette? (2011).Center on Addiction and Substance Abuse, Columbia University.

[36] Room, R., Fischer, B., Hall, W., Lenton, S. and Reuter, P. (2010). *Cannabis Policy: Moving Beyond Stalemate*, Oxford, UK: Oxford University Press.

psychotic symptoms, and can increase the risk of psychotic symptoms, dependence, and increase adverse effects on the respiratory and cardiovascular systems in regular users.[37, 38]

In the U.S., for example, since 1990, cannabis emergency rates have been rising sharply for cannabis-related admissions.Visits to hospital emergency departments because of cannabis use have risen from an estimated 16,251 visits in 1991 to more than 374,000 in 2008.[39] That has accompanied a rise in potency from 3% to 10% during the same time period, according to the Potency Monitoring Project at the University of Mississippi.[40] Many researchers have pointed to higher potency as a possible reason for skyrocketing treatment admissions rates globally for cannabis.[41]THC concentration in the Netherlands, has increased from 9% to 15% in the past 10 years, and from 5% to 8% in Germany from 1997-2009.The increase in THC content is attributed to indoor cultivation and improved breeding.[42]

Cannabis and the Respiratory and Cardiovascular Systems

Because cannabis is frequently smoked, bronchial and lung diseases are not uncommon.Cannabis smoke is composed of many of the same ingredients that are present in tobacco smoke (e.g., carbon monoxide, cyanide), with the exception of THC in cannabis, and nicotine in tobacco.Infrequent cannabis users may experience burning and stinging of the mouth and throat, along with a heavy cough, and regular cannabis smokers often have many of the same respiratory problems as tobacco smokers, including daily cough and phlegm production, frequent acute chest illness, and an increased risk of lung infections and pneumonia.Even in the absence of tobacco, regular cannabis smoking can lead to both acute and chronic bronchitis, at a comparable rateto cigarette smoking.Long-term studies from the USA and New Zealand have shown that regular cannabis smokers report more symptoms of chronic bronchitis than non-smokers.[43] There is a four-fold greater quantity of cannabis smoke particles (tar) in the respiratory tract compared to the tar generated from the same amount of smoked tobacco.This inconsistency is attributed to

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[37]Hall W & Degenhard L (2009). Adverse health effects of non-medical cannabis use.*Lancet, 374*:1383-1391.

[38]NIDA, Research Report Series: Cannabis Abuse, 2010

[39] Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality. (2011). *Drug Abuse Warning Network, 2008: National Estimates of Drug-Related Emergency Department Visits.* HHS Publication No. SMA 11-4618. Rockville, MD.

[40] See, for example http://news.olemiss.edu/index.php?option=com_content&view=article&id=4545%3Acannabispotency051409&Itemid=10

[41] See for example Compton, W., Grant, B., Colliver, J., Glantz; M., Stinson, F. (2004). Prevalence of Cannabis Use Disorders in the United States: 1991-1992 and 2001-2002*Journal of the American Medical Association.*. 291:2114-2121. And Sabet, K. (2006). The (often unheard) case against cannabis leniency. In *Pot Politics* (Ed. M. Earleywine).Oxford University Press, pp. 325-355.

[42] UNODC, The Cannabis Market, 2011.

[43]Tetrault, J.M.*, et al.*Effects of cannabis smoking on pulmonary function and respiratory complications: a systematic review. *Arch Intern Med* 167, 221-228 (2007).

differences in the way cannabis is smoked compared to tobacco – for example, cannabis smokers hold their breath significantly longer than tobacco smokers.Approximately twice as many immune cells are present in the lungs of cannabis smokersbecause of an inflammatory response to noxious components.This impairs the immunological competence of the respiratory system, thus increasing health service needs due to respiratory infections.HIV positive individuals who smoke cannabis may be predisposed to pulmonary infections and pneumonia, a consequence that warrants further investigation given the prevalence of cannabis use for medicinal purposes in this population.[44]

Cannabis smoke contains many of the carcinogens present in cigarette smoke, and holding the breath exposes the lungs to carcinogenic smoke for a longer period. The smoke also includes an enzyme that converts some hydrocarbons into a cancer-causing form, potentially accelerating the changes that produce malignant cells. Animal lungs exposed to cannabis smoke developed abnormal cell growth and accelerated malignant transformation, to a greater extent than those exposed to tobacco. [45]

Cannabis may produce adverse effects on the cardiovascular system; because cannabis and THC cause a dose-dependent increase in heart rate, concern exists about adults with cardiovascular disease.Cannabis use can cause an increase in the risk of myocardial infarction 4.8-fold in the hour after use, and provokes angina in patients with heart disease. [46]

Cannabis and Pregnancy

Cannabis use during pregnancy may cause harm to the fetus; however, associations that have been reported are subject to confounding variables, particularly because cannabis users are more likely to use tobacco, alcohol, and other illicit drugs while pregnant, and have poorer nutrition and are less likely to seek prenatal care than women who do not use cannabis.Nevertheless, animal studies have shown that rats exposed to THC in utero show difficulty with learning and memory tasks, as well as structural and functional changes in the hippocampus.In women, cannabis smoking during pregnancy leads to decreased birthweight, most likely due to the effects of carbon monoxide on the developing fetus.Additionally, infants exposed to cannabis in utero show developmental delays in the visual system as well as tremors shortly after birth, though these differences appear to subside after one month.Older children have some deficits in higher cognitive processes, such as perceptual organization and planning. [47]

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[44]Tashkin, DP (2005). Smoked cannabis as a cause of lung injury.*Monaldi Archives for Chest Disease, 63(2):*93-100.

[45]NIDA, Research Report Series: Cannabis Abuse, 2010

[46]Hall W & Degenhard L (2009). Adverse health effects of non-medical cannabis use.*Lancet, 374*:1383-1391.

[47]Hall W & Degenhard L (2009). Adverse health effects of non-medical cannabis use.*Lancet, 374*:1383-1391.

Cannabis and Cognitive Effects

Cannabis use most often begins in teenage years and peaks in the early and middle 20s.Adolescents who use cannabis are at risk for a number of harmful drug-related effects, and larger deficits can be attributed to higher dose and earlier age of use onset.Cannabis-dependent teens show short-term memory deficits as well as delayed recall of visual and verbal information.Even after six weeks of abstinence, cannabis users do not show significant improvement in short-term memory ability.Importantly, these deficits were not seen in adolescents who use other drugs, suggesting that cannabis has a unique influence on memory and learning.Teens who continue to use cannabis heavily show poorer complex attention functioning as well as slower psychomotor speed, poorer sequencing ability, and difficulties in verbal story memory. [48] Other studies show that long-term heavy cannabis users do show impairments in memory and attention that endure beyond the period of intoxication and worsen with increasing years of regular cannabis use.[49]

Cannabis and Mental Illness

Cannabis use is associated with psychotic symptoms, schizophrenia, anxiety, and depression.When compared with those who have never used cannabis, young adults who began using the drug at age 15 or younger are twice as likely to develop a psychotic disorder, and four times as likely to experience delusional symptoms.This trend persisted in a study examining sibling pairs, thus reducing the likelihood that the association was related to unmeasured genetic or environmental influences.A dose-response relationship was found; that is, the longer the duration since initial cannabis use, the higher the risk of psychosis-related outcomes.[50]Room et al. write, "Cannabis use and psychotic symptoms are associated in general population surveys and the relationship persists after adjusting for confounders. The best evidence that these associations may be causal comes from longitudinal studies of large representative cohorts."[51]The most consistent linkages are between cannabis use and psychosis, and there are sufficient data to suggest that cannabis use can play a causalrole in the emergence of psychosis in some patients depending on their genetic makeup, age of first use, and other factors. Causality is of course difficult to establish, since many cannabis users use other drugs.[52]

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[48] Schweinsburg AD, Brown, SA, & Tapert, SF (2008).The influence of cannabis use on neurocognitive functioning in adolescents.*Current Drug Abuse Reviews, 1*:99-111.

[49] Solowij, N.*, et al.* (2002). Cognitive functioning of long-term heavy cannabis users seeking treatment. *Journal of the American Medical Association,* 287, 1123-1131.

[50] McGrath, et al. (2010). Association between cannabis use and psychosis-related outcomes using sibling pair analysis in a cohort of young adults.*Archives of General Psychiatry, 67(5):*440-447.

[51] Room, R., Fischer, B., Hall, W., Lenton, S. and Reuter, P. (2010). *Cannabis Policy: Moving Beyond Stalemate*, Oxford, UK: Oxford University Press.

[52] See for example: Large, M., Sharma S, Compton M., Slade, T. & O., N. (2011). Cannabis use and earlier onset of psychosis: a systematic meta-analysis. *Archives of General Psychiatry.* 68. Also see Arseneault L*, et al.* (2002). Cannabis use in adolescence and risk for adult psychosis: longitudinal prospective study. *British Medical Journal.* 325, 1212-1213.

A number of longitudinal studies throughout the world have found that users who had tried cannabis by age 18 are significantly more likely to be diagnosed with schizophrenia than those who have not used the drug, and approximately 13% of cases of schizophrenia could be averted if cannabis use was prevented.While the exact nature of this relationship is unclear, the amount of the drug used, the age at first use, and genetic vulnerability may play a role.It is possible that users who carry a specific variant of the gene for catechol-O-methltransferase (COMT), responsible for an enzyme that degrades neurotransmitters such as dopamine and norepinepherine, may have a particularly increased risk of developing schizophrenia. [53], [54]

CBR activation in the amygdala can produce anxiety and increase reactivity to stressful events; THC can directly activate both of these mood states.Current cannabis smokers may be in a persistent state of heightened anxiety, which can reduce their reactions to stressful situations, particularly when compared to non-users.These effects are seen at a psychobiological level, as current cannabis users have lower levels of the stress hormones cortisol and adrinocorticotropic (ACTH) – levels that are correlated with length of exposure.These neurological deficits may also be responsible for reduced motivation and poor capacity to cope with stress, which could lead to cannabis users dealing with those issues by using opioids, alcohol, benzodiazepines, and other illicit drugs. [55]

Cannabis Use, Learning and Other Life Outcomes

Research has found that cannabis negatively effects attention, memory, and learning, even after the short-term consequences of the drug recede.[56] Indeed, a New Zealand study found that cannabis is linked with dropping out of school, and subsequent unemployment, social welfare dependence, and an overall feeling of inferior life satisfaction compared to non-cannabis using teens. These results remained significant even after controlling for family socio-economic background; family functioning; exposure to child abuse; childhood and adolescent adjustment; early adolescent academic achievement; and comorbid mental disorders and substance use.[57]

Disengagement from school often begins before mid-adolescence, and may co-occur with learning difficulties.Students struggling with or frustrated by school may turn to relationships with deviant peers; in this context, most adolescence substance use

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[53]Hall W & Degenhard L (2009). Adverse health effects of non-medical cannabis use.*Lancet, 374*:1383-1391.

[54]NIDA, Research Report Series: Cannabis Abuse, 2010

[55] Somaini et al (2011). Psychobiological responses to unpleasant emotions in cannabis users.*European Archives of Psychiatry and Clinical Neuroscience, Jul 20* [Epub ahead of print]

[56] Schweinsburg, A.D.; Brown, S.A.; and Tapert, S.F. The influence of cannabis use on neurocognitive functioning in adolescents. *Curr Drug Abuse Rev* 1(1):99-111, 2008.

[57] Fergusson, D. M. and Boden, J. M. (2008), Cannabis use and later life outcomes. *Addiction*, 103: 969–976.

begins.[58]According to the U.S. National Survey on Drug Use and Health, youth with poor academic results were more than four times as likely to have used cannabis in the past year than youth with an average of higher grades." This is consistent with an exhaustive meta-analysis examining four dozen different studies by Macleod and colleagues, published by Lancet, who found that cannabis use is consistently associated with reduced grades and a reduced chance of graduating from school.[59]Ellickson and colleagues at the RAND Corporation surveyed almost 6,000 students aged 13 to 23 and found that the teens who smoked cannabis from once a week to monthly at age 13, decreased their abuse by age 18, and as young adults smoked 3 to 10 times a year, lagged behind all other groups in earnings and education when resurveyed at age 29.[60]

In addition, the U.S. National Institute on Drug Abuse has cited several studies linking employee cannabis use with "increased absences, tardiness, accidents, workers' compensation claims, and job turnover."[61] Examining drug-tested federal employees, researchers found that those who tested positive for cannabis on a pre-employment urinalysis 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 cannabis use.[61]

Cannabis users often have strained interpersonal relationships. In a longitudinal study, after controlling for confounding variables, young adults showed a dose dependent relationship between relationship and life satisfaction and cannabis use.Higher levels of cannabis use were associated with lower satisfaction with intimate romantic relationships and lower satisfaction with life, including satisfaction with work, family friends, and leisure pursuits.[62]

Reasons for Cannabis Use

In the United States, data are available for motivation to use cannabis in adolescents..A study examining self-reported reasons for the use of cannabis among nationally representative samples of American high school seniors from 1976 through 2005 found that social/recreational reasons were the most commonly reported reasons for the use of cannabis, specifically "to have a good time", "to

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[58] Kliewer, W., & Murrelle, L. (2007). Risk and protective factors for adolescent substance use: Findings from a study in selected Central American countries.*Journal of Adolescent Health, 40*:448-455.

[59] Macleod, J.; Oakes, R.; Copello, A.; Crome, I.; Egger, M.; Hickman, M.; Oppenkowski, T.; Stokes-Lampard, H.; and Davey Smith, G. Psychological and social sequelae of cannabis and other illicit drug use by young people: A systematic review of longitudinal, general population studies. *Lancet* 363(9421):1579-1588, 2004.

[60] Ellickson, P.L.; Martino, S.C.; and Collins, R.L. Cannabis use from adolescence to young adulthood: Multiple developmental trajectories and their associated outcomes. *Health Psychology* 23(3):299-307, 2004.

[61] National Institute on Drug Abuse (NIDA). (2011). *Research Report Series: Cannabis Abuse.* Accessed November 2011 at http://www.drugabuse.gov/ResearchReports/Cannabis/cannabis4.html

[62] Fergusson, DM, & Boden, JM. (2008). Cannabis use and later life outcomes.*Addiction, 103*:969-976.

experiment", and "to get high".[63]Other studies have found that young adult men are more likely to use cannabis to increase or decrease the effects of other drugs, to seek deeper insights, to have a good time, and because they are addicted. Young adult women are more likely to use cannabis to help them cope and to dampen negative affect.Reasons for cannabis use for both men and women include fitting in socially, using it to cope, to conform to social norms, for mind expansion, and to alter perceptions.While there are differences for use between the sexes, no racial or ethnic differences have been found. [64, 65]

Best Practices in Cannabis Prevention and Treatment

Cannabis as a Gateway Drug

Consistent evidence has shown that cannabis use almost always precedes the use of other illicit drugs, including cocaine, methamphetamine, hallucinogens (including LSD and ecstasy), illegally obtained prescription drugs, and opiates, such as heroin or morphine.Cannabis users are significantly more likely than non-users to use other illicit drugs, and more frequent use of cannabis and younger age of initiation to the drug strengthen this relationship, even after controlling for potential confounding variables and studying twins.This use pattern is strongest in adolescents and declines with age, possibly because of increased social maturity on the ability to resist illicit drug use. [66]

There are multiple hypotheses as to why cannabis acts as a gateway drug.Animal studies have shown evidence that brain chemistry is altered with increased use of cannabis, and these changes may increase responsiveness to other illicit drugs.Animal studies also indicate that the cannabinoid and opioid systems in the brain interact with each other, and cannabinoid self-administration "primes" animals to self-administer opioids, as CBRs and opioid receptors overlap in some areas of the brain.These studies have also shown that chronic exposure to THC creates a tolerance to some opioids, and that heroin reinstates cannabinoid-seeking behavior.While well-controlled studies in humans are needed to confirm these findings, twin studies that allow researchers to control for genetic influences and environment, have indicated that those factors alone are not wholly responsible for further drug use. [67, 68, 69]

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[63] Terry-McElrath, Y., O'Malley, P., and Johnston, L. (2009). Reasons for Drug Use among American Youth by Consumption Level, Gender, and Race/Ethnicity: 1976–2005J Drug Issues. 2009 ; 39(3): 677–714.

[64] Patrick M. et al (2011). Adolescents' reported reasons for alcohol and cannabis use as predictors of substance use and problems in adulthood.*Journal of Studies on Alcohol and Drugs, 72*:106-116.

[65] Patrick M. et al (2011). Age-related changes in reasons for using alcohol and cannabis from ages 18 to 30 in a national sample.*Psychology of Addictive Behaviors;25(2):*330-339.

[66] Fergusson DM, Boden JM, & Horwood LJ (2006). Cannabis use and other illicit drug use: Testing the cannabis gateway hypothesis.*Addiction, 101,* 556-569.

[67] Room R, Fischer B, Hall W, Lenton S, & Reuter P (2010).Cannabis policy: Moving beyond stalemate.New York: Oxford.

Finally, data from the Christchurch Health and Development Study in New Zealand 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". [48]

Risk and Protective Factors

Over the past two decades, much of the research in drug prevention has centered on trying to determine what factors lead to the initiation of drug use and how and why this behavior progresses. There is a robust science base and framework for identifying and addressing the risk factors and protective factors for drug use.Both risk and protective factors affect youth at different life stages, from pregnancy through young adulthood, as well as well as in various domains including individual, peer, family, school and community.[70]

When not properly identified and dealt with early on negative behavior can further a child's risks for drug use and other problems. Effective preventative interventions reduce risk and increase protection at each developmental stage, as well as within each domain.[71]

Risk Factors	Domain	Protective Factors
Early Aggressive Behavior	Individual	Self-Control
Lack of Parental Supervision	Family	Parental Monitoring
Substance Abuse	Peer	Academic Competence
Drug Availability	School	Anti-drug Use Policies
Poverty	Community	Strong Neighborhood Attachment

Source: Preventing Drug Abuse Among Children and Adolescents, NIDA

The possible impact of any particular risk or protective factor changes as a person ages.Specific risk and protective factors in particular domains, such as the home environment, can have a greater influence on younger children, while peer level risk and protective factors can be more important for adolescents.Early life family dynamics can either increase the risk for drug use, given poor nurturing or ineffective

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[68] Hall, WD (2006). Cannabis use and the mental health of young people.*Australian and New Zealand Journal of Psychiatry, 40*:105-113.

[69] Maldonado, R., Berrendero, F., Ozaita, A., & Robledo, P. (2011). Neurochemical basis of cannabis addiction.*Neuroscience, 181*:1-17.

[70]*Preventing Drug Abuse Among Children and Adolescents: Risk Factors and Protective Factors*.National Institute on Drug Abuse.Accessed December 2, 2011 from http://www.drugabuse.gov/prevention/risk.html

[71] Ibid

parenting, or reduce the risk through developing strong initial child parent bonding and providing clear, consistent discipline, which are important protective factors.[72]

Research shows that crucial periods of risk for drug use and abuse occur during key lifetransitions, such moving from elementary school to middle school.One of the most salient risks for youth drug use is associating with drug abusing peers. Other important community level risk factors for drug initiation are access to and availability of drugs, drug trafficking patterns, and normative beliefs that drug use is "generally tolerated".[73]

Certain family and environmental factors may increase the risk for cannabis use.In addition to disengagement from school, parents or other family members who have problems with alcohol and drugs may model drug use for their children, have difficulty monitoring their behavior, or enhance the availability of substances.Conflicted families may not offer the support for adolescents to deal with stressors in their lives, monitor their behavior, or may be a stressor themselves, potentially causing drug use as a form of stress relief.Exposure to community violence increases risk as well; high levels of stress are associated with witnessing and being victimized by violent crime, causing teenagers to turn to drugs as a form of stress relief, and there are often more drug opportunities in high-violence areas.Additionally, adolescents who display impulsive behavior may be more likely to initiate drug use.[74]

While there are multiple risk factors for cannabis use, protective factors exist as well.Parents who are religious are more likely to support and monitor their children, and to communicate values regarding behavior.They are also more likely to have children who are religious, and religious adolescents engage in less deviant behavior, including substance use.This is potentially because of personal beliefs regarding behavior, or as a result of support for healthy behavior from religious institutions.Family communication and cohesion are also protective, as these families are often more supportive and adolescents are reinforced for adaptive coping behavior.Additionally, the feeling of being cared for and connected to parents or guardians protects adolescents from substance use.School engagement, including completing homework and participating in extracurricular activities, is protective.Teachers can provide a great deal of support for adolescents, as a buffer for negative peer interactions and helping to develop a feeling of connection with school. [75, 76]

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[72]*NIDA InfoFacts: Lessons Learned from Prevention Research.*National Institute on Drug Abuse.Accessed December 2, 2011 from http://www.drugabuse.gov/infofacts/lessons.html

[73]*Preventing Drug Abuse Among Children and Adolescents: Risk Factors and Protective Factors*.National Institute on Drug Abuse.Accessed December 2, 2011 from http://www.drugabuse.gov/prevention/risk.html

[74] Kliewer, W., & Murrelle, L. (2007). Risk and protective factors for adolescent substance use: Findings from a study in selected Central American countries.*Journal of Adolescent Health, 40*:448-455.

[75] Ibid

The risk and protective factor framework provides an important way to understand the causes of substance use andabuse, with the more risks a child is exposed to the more likely that child will use or abuse drugs. One of the crucial goals of drug prevention is to alter the equation between risk and protective factors, in order to amplify the number of protective factors in relation to risk factors across all of the relevant domains and life stages.

When focusing on substance use/abuse prevention, the definition associated with the terms "high need youth" or "high-risk youth," which typically describes youth from families and/or communities with a lower socioeconomic status, must be broadened to include those from families and/or communities with more disposable income. Contrary to the popular belief that children with higher levels of disposable income are at low risk for various problems, these youth are actually prone to problems in several domains – particularly substance use. [77]Longitudinal studies from both the United States and France have shown that adolescents from affluent families more often experiment with cannabis. However, they may not be as likely to become addicted.It is possible that this is due to the fact that adolescents from higher socioeconomic (SES) families are more concerned about the future (e.g., they are more concerned about endangering their school performance and career prospects), and their peers may be less likely to condone drug use. [78, 79] Moreover, it is also possible that adolescents from affluent families have more opportunities to stop the escalation to dependence.Studies have also found that those youth with multiple risk factors and few protective factors are the most vulnerable to drug use abuse and addiction, and less likely to get interventions and treatment, especially when they drop out of school.[80]

Media Messages

In the past ten years, the internet has revolutionized media. Social networking sites, inexpensive mobile technology, and the increase of internet reach and speed have meant that young people are routinely exposed to various kinds of messaging and advertising. Unfortunately, this has also meant that messages directly or indirectly promoting alcohol, tobacco, and other drugs have proliferated. According to a survey done for the U.S. government by the respected Nielson media company, nearly one million American teens, or 5% of teens viewing online videos, viewed drug-related

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[76] Cheng, TC & Lo, CC. (2011). A longitudinal analysis of some risk and protective factors in marijuana use by adolescents receiving child welfare services.*Children and Youth Services Review, 33*:1667-1672.
[77] Luthar, S. The culture of affluence; Psychological costs of material wealth. Child Development. 2003:74:6:1581-1593.
[78] Humensky, J. L. (2010).Are adolescents with high socioeconomic status more likely to engage in alcohol and illicit drug use in early adulthood?*Substance Abuse Treatment, Prevention, and Policy, 5,* 19-28.
[79] Legleye, S., Janssen, E., Beck, F., Chau, N., and Khlat, M. (2011).Social gradient in initiation and transition to daily use of tobacco and cannabis during adolescence: A retrospective cohort study.*Addiction, 106,* 1520-1531.
[80] Latimer, W. and Zur, J. (2010). Epidemiologic trends of adolescent use of alcohol, tobacco, and other drugs. *Child and Adolescent Psychiatric Clinics of North America.* 19(3):451-64. Review.

videos in June, 2008. Teens watched 1.2 million drug-related videos during the one-month period. More than a third (35%) of teens who viewed drug-related video are younger than 16. Almost 40% of drug-related videos contain explicit use of drugs and/or intoxication.[81]

When examining content of prime time television, content concerning drug abuse is scarce, particularly when compared to messages about food and nutrition, alcohol use, and smoking – three topic areas commonly portrayed.An analysis undertaken by Byrd-Bredbenner and colleagues found that information about drug abuse appeared in only 0.04% of a sample of prime time television shows in the United States.This is worrisome, as these shows lack messages and examples for children and adolescents as to how best to approach and handle drug use and abuse.[82]

Other studies have examined the types of drug use messages contained in music lyrics and music videos, and, in one such study, Roberts and colleagues found that almost in 1 in 5 songs sampled contained references to illegal drugs.[83] Brookshire and colleagues found that adolescents, particularly those who listen to rap music, are exposed to lyrics that portray drug use in a positive manner.[84]

Young People and Perceptions of Risk

Softening attitudes are problematic, as research demonstrates that illegal drug use among youth declines as the perception of risk (whether or not you think a drug is dangerous) and social disapproval increases. A number of journal articles[85] have substantiated "the powerful cross time association between perceived risk and use

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[81] Gibs, J. and Brauer, J. *Teens Viewing of Drug and Alcohol-Related Videos Online: Custom Study Conducted on Behalf of ONDCP,* Nielson Online. Accessed November 2011 at https://www.ncjrs.gov/ondcppubs/publications/pdf/teenviewing_darvideos_online.pdf.

[82] Byrd-Bredbenner, C., Finckenor, M., & Grasso, D. (2003). Health related content in prime-time television programming.*Journal of Health Communication, 8*:329-341.

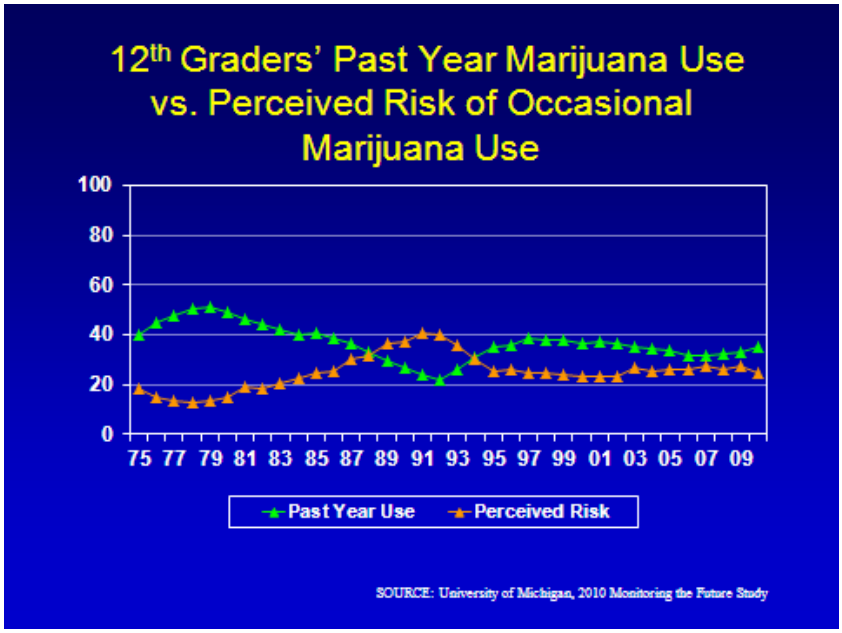
[83] See Roberts et al. (2002). *Substance Use in Popular Music Videos*. Accessed November 2011 at http://www.scenesmoking.org/research/SubstanceUseIinMusic.pdf andDuRant, R.H., Rome, E.S., Rich, M., Allred, E., Emans, J., & Woods, E.R. (1997). Tobacco and alcohol use behaviors portrayed in music videos: A content analysis. *American Journal of Public Health,* 87 (7), 1131-1136.

[84] Brookshire, T., Davis, C., Stephens, E., and Bryant, S. (2003). Substance Use References in the Lyrics of Favorite Songs of African-American Adolescents. *Psychology and Social Sciences*, Issue 1. Accessed November 2011 at http://www.jyi.org/volumes/volume8/issue1/articles/brookshire.html

[85] See multiple studies, including Bachman, J.G., Johnston, L.D., & O'Malley, P.M. (1990). Explaining the recent decline in cocaine use among young adults: Further evidence that perceived risks and disapproval lead to reduced drug use. *Journal of Health and Social Behavior*, 31, 173-184.Bachman, J.G., Johnston, L.D., & O'Malley, P.M. (1998). Explaining the recent increases in students' cannabis use: The impacts of perceived risks and disapproval from 1976 through 1996. *American Journal of Public Health*, 88, 887-892.Bachman, J.G., Johnston, L.D., & O'Malley, P.M. (1988). Explaining the recent decline in cannabis use: Differentiating the effects of perceived risks, disapproval and general lifestyle factors. *Journal of Health and Social Behavior*, 29, 92-112. Johnston, L.D. (1991). Toward a theory of drug epidemics. In R.L. Donohew, H. Syper, & W. Bukoski (Eds.). Persuasive communication and drug abuse prevention (pp. 93-132). Hillsdale, NJ: Lawrence Erlbaum. Bachman, J.G., Johnston, L.D., & O'Malley, P.M. (1998). *National survey results on drug use from Monitoring the Future study, 1975-1998: Volume I: Secondary school students*. (NIH Publication No. 98-4345).

that cannot be explained away by concurrent shifts in a number of other lifestyle factors. Perceived risk remains a powerful predictor of use, even when controlling for a host of other known risk factors (Bachman et al., 1988; Bachman, Johnston, &O'Malley, 1990 & 1998). This research also finds that these attitudes are more able to explain the changes in use, rather than the inverse. This fact is clearly demonstrated when looking at U.S. school-based survey data, such as Monitoring the Future (MTF) trend data. For example, according to the Monitoring the Future National Survey Results on Drug Use, 1975-2009, Volume I, Secondary School Students 2008, "the amount of perceived risk associated with using cannabis fell during the earlier period of increased use in the late 1970s, and fell again during the more recent resurgence of use in the 1990s. Indeed perceived risk among 12th graders began to decline a year before use began to rise in the upturn of the 1990s, making perceived risk a leading indicator of change in use. The decline in perceived risk halted after 1997 for 8th and 10th graders, and annual prevalence began to decline a year or two later. Again, perceived risk was a leading indicator of change in use, as it has been proven to be for a number of drugs."

As further evidenced by the chart below, the extent to which youth understand that use of a specific drug is harmful dramatically and inversely influences the substance use rates for that drug.



Many governments have reported that media messages that normalize drug use and calls for legalization of cannabis, contribute to more widespread acceptance of drug use.And in the past, softened youth attitudes toward drug use have preceded an increase in use.The U.S. cites statistics that between 2002 and 2009, the percentage of youths aged 12 to 17 perceiving great risk declined for cannabis and that this attitude change contributed to increases in use. The 2010 University of Michigan Monitoring the Future Survey revealed the perceived harm for smoking cannabis occasionally or regularly has been decreasing among the 8th grade since 2007. Social

disapproval for smoking cannabis once or twice, occasionally, and regularly has been decreasing among 8th graders since 2007.

Prevention

Cannabis prevention efforts are critical because cannabis is often the first illegal drug used by youth. Preventing substance use before it begins not only makes common sense, it is also cost-effective.For every dollar invested in prevention, a savings of up to $10 in treatment can be realized.[86]Generalized universal prevention programs to help build strong families and provide youth with the skills to make good, healthy decisions are necessary components of effectivedrug prevention. In addition, there is also a need to focus specifically on the community risk and protective factors explicitly related to the initiation and use of, illegal drugs which include, social norms, access, availability and perceptions of harm.For example, critical policy and environmental interventions (e.g. policies outlawing cannabis storefronts or limiting the sale of drug paraphernalia) are unique to substance abuse prevention and may not be as relevant to other forms of prevention such as bullying, violence, etc.

Prevention science in the field of substance abuse has made great progress in recent years resulting in effective intervention to help children reduce the risk of initiating drug use at every step along their developmental path.Working more broadly with families, schools, and communities, scientists have found effective ways to help people gain the skills and approaches to stop problem behaviors, such as drug use, before they occur.

Decades of research demonstrate that there are core principles of drug prevention that strengthen prevention programs and increase effectiveness.[87]For example, according to the U.S. National Institute on Drug Abuse (NIDA), which conducts more than 85 percent of the world's research on drug abuse:

- Prevention programs should enhance protective factors (e.g., parental monitoring, bonding, supporting and warm parenting, success in school, participation in extracurricular activities) and reduce risk factors (e.g., deviant peers, academic failure, a caregiver who is a substance abuser, affectionless control, ready availability of drugs in community, and policies that normalize drug use).
- Prevention programs should be localized and community specific, addressing the actual problems and drugs threatening the community, the risk factors unique to the community, and strengthening the community's identified protective factors. However, the core elements of the research-based program must be retained.
- Prevention program elements should be tailored for the target audience (e.g., family-based prevention should enhance family bonding, and other parenting

[86] U.S. Department of Health and Human Services, National Institutes of Health, National Institute on Drug Abuse (2003). Preventing Drug Abuse among Children and Adolescents: A Research-Based Guide for Parents, Educators, and Community Leaders (2nd Edition). NIH Publication No. 04-4212 (A).
[87] National Institutes of Health, National Institute on Drug Abuse (2003). Preventing Drug Use among Children and Adolescents: A Research Based Guide for Parents, Educators, and Communities. NIH Publication No. 04-4212 (A).

protective factors, while school-based prevention should provide youth with assertiveness, communication, and drug resistance skills).

- Prevention programs are most effective during key transition periods when youth are at most risk (e.g., transition from middle school to high school).
- Prevention programs implemented in multiple settings (e.g., in the school and home), for longer periods of time, with subsequent follow-up sessions, are most effective.
- Prevention programs implemented in the community across multiple settings (e.g., faith-based organizations, schools, and the media) should be consistent in messaging across settings.

A comprehensive multi-sectorapproach to cannabis prevention has gained traction in recent years.This community-wide approach, rather than focusing on implementingonlyone particular program, works to engage an entire communityin the following evidence-based processes: 1) assess their prevention needs based on epidemiological data ; 2) build their prevention capacity ; 3) develop a strategic plan ; 4) implement effective community prevention programs, policies and practices ; and 5) evaluate their efforts for outcomes.This type of comprehensive approach identifies a community's specific problems and program/ service gaps, as well as its assets and resources. This allows a community to plan, implement and evaluate its efforts across community sectors in relevant settings for individuals, families, schools, workplaces and the community at large.

An example of this approach are the drug-free community coalitions, currently in existence in the United States, Mexico, Peru, Guatemala, Honduras, El Salvador, Colombia, Mexico, Brazil and South Africa. Drug-free community coalitions develop and implement data-driven strategic plans to increase awareness, change norms, laws, practices, and procedures, engage the media as well as work with partner organizations to ensure that the right mix of science based programs and services are available to address a community's unique drug issues. In 2010, an independent evaluation found that communities with such coalitions had significant reductions in alcohol, tobacco, and.cannabis use among middle and high school age youth while perception of risk increased.[88]

Even if community-based approaches have shown their effectiveness, it is also important to mention that other specific interventions, like family-based approaches, life-skills building, and behavior skills enhancement games have also proven to be effective.[89]

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[88] Office of National Drug Control Policy (2010). National Evaluation of the Drug Free Communities Support Program. Available online: http://www.ondcp.gov/publications/pdf/dfc_eval_data_fs.pdf

[89] See Faggiano F, Vigna-Taglianti F, Versino E, Zambon A, Borraccino A, Lemma P. (2008). School-based prevention for illicit drugs' use. The Cochrane Reviews, Found December 2011 at **http://summaries.cochrane.org/CD003020/school-based-prevention-for-illicit-drugs-use**. Also see Gates S, McCambridge J, Smith LA, Foxcroft D. (2009). Interventions for prevention of drug use by young people delivered in non-school settings. The Cochrane Review. Found December 2011 at http://summaries.cochrane.org/CD005030/interventions-delivered-to-young-people-in-non-school-

Treatment

Since it is established that 1 in 10 cannabis users will become dependent, and that cannabis addiction produces a withdrawal syndrome, evidence-based cannabis treatment plays a vital role in any discussion of cannabis.

For those who have not progressed to full cannabis addiction, screening, brief interventions and referral to treatment (SBIRT) mechanisms may be appropriate. SBIRT services include an initial drug screens by general primary care physicians or counselors to identify at-risk persons, brief advice—such as a one-time intervention for short consultation and literature, brief interventions – such as one to twelve sessions of substance use intervention, and, finally, (if necessary), referral to treatment for dependent users to receive specialized services, case management, and follow-up support in the community.

A major method to treat cannabis addiction is through cognitive-behavioral therapy (CBT). Cognitive-behavioral therapy comprises a combination of approaches meant to increase self-control. Specific techniques include exploring the positive and negative consequences of ongoing use, self-monitoring to recognize drug cravings early on and to identify high risk situations for use, and developing strategies for coping with and avoiding high-risk situations and the desire to use. A central element of this treatment is anticipating likely problems and helping patients develop effective coping strategies. Research indicates that the skills individuals learn through cognitive-behavioral approaches remain after the completion of treatment. In several studies, most people receiving a cognitive-behavioral approach maintained the gains they made in treatment throughout the following year.[9091]

Motivational approaches, such as motivational interviewing, are best used to produce rapid, internally motivated change.These brief interventions focus on a non-confrontational therapeutic alliance as one to facilitate a patient's willingness to change.These types of therapy can be particularly useful when motivating a patient to seek treatment. Interpersonal, family, and couples therapy are used to treat drug use in the system in which was developed and maintained.Including family is particularly useful for helping patients stay in treatment (this is particularly true for adolescents), and addressing the reasons for which drug use began.[92]

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settings-for-the-prevention-of-drug-use **http://summaries.cochrane.org/CD005030/interventions-delivered-to-young-people-in-non-school-settings-for-the-prevention-of-drug-use**.

[90] See National Institute on Drug Abuse, Evidence-Based Approaches to Drug Abuse Treatment. Accessed November 2011 at http://www.nida.nih.gov/podat/Evidence2.html

[91] Carroll, K.M., et al. The use of contingency management and motivational/skills-building therapy to treat young adults with cannabis dependence. *Journal of Consulting and Clinical Psychology* 74(5):955-966, 2006.

[92] Carroll, KM (2005). Recent advances in the psychotherapy of addictive disorders. *Current Psychiatry Reports, 7*:329-336.

Budney and colleagues[93] have found that treatment approaches using contingency management principles, which involve giving clients the chance to earn low-cost incentives in exchange for drug-free urine samples, are effective in stopping continued cannabis use. These incentives include prizes of small monetary value but that might be important for the client demographic (e.g. movie vouchers for youth).

The Cannabis Treatment Project Research Group found, through a multisite trial, that Motivational Enhancement Therapy (MET) has proven effective for stopping cannabis dependence. [94] MET strategies consist of an initial assessment session, followed by two to four individual treatment sessions with a therapist. In the first treatment session, the therapist provides feedback to the initial assessment, eliciting discussion about personal drug use and provoking self-motivational statements. Coping strategies for high-risk situations are suggested and discussed with the patient. In further sessions, the therapist monitors change, reviews cessation strategies being used, and continues to encourage commitment to change or sustained abstinence. Patients sometimes are encouraged to bring a significant other to sessions. MET has also been used successfully with adult cannabis-dependent individuals in combination with cognitive-behavioral therapy, comprising a more comprehensive treatment approach.[95]

There has also been some work done on finding a medication to treat cannabis dependence, similar to methadone or buprenorphine for opiate addiction. These are in the early stages of development but oral THC combined with lofexidine has been shown to curb withdrawal symptoms.Various cannabis-based medications are under investigation to harness the new knowledge and therapeutic potential of the cannabinoid system.[96]

Cannabis Control and Policy Measures

Cannabis remains under international control, included in Schedules I and IV of the 1961 Single Convention on Narcotic Drugs, as amended by the 1972 Protocol (the "1961 Convention. Though the vast majority of governments are signatories to international drug control treaties rendering cannabis illegal, countries around the world have experimented with varying types of cannabis control policies. This section briefly summarizes different cannabis policy experiences around the world. The section is not meant to be exhaustive; the references provide greater detail on the issues.

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[93] Budney, A.J.; Moore, B.A.; Rocha, H.L.; and Higgins, S.T. Clinical trial of abstinence-based vouchers and cognitive behavioral therapy for cannabis dependence. *Journal of Consulting and Clinical Psychology* 74(2):307-316, 2006.See also Budney, A.J.; Roffman, R.; Stephens, R.S.; and Walker, D. Cannabis dependence and its treatment. *Addiction Science & Clinical Practice* 4(1):4-16, 2007.

[94] Brief treatments for cannabis dependence: Findings from a randomized multisite trial. *Journal of Consulting and Clinical Psychology* 72(3):455-466, 2004.

[95] See National Institute on Drug Abuse, Evidence-Based Approaches to Drug Abuse Treatment. Accessed November 2011 at http://www.nida.nih.gov/podat/Evidence2.html

[96] NIDA Research Report Series, *Marijuana Abuse*, 2010

It is critical to keep in mind that, as concluded by the RAND Corporation in an exhaustive report about cannabis legalization, in no Western country is a cannabis user at "much risk of being criminally penalized for using cannabis".[97] Analyses by Kilmer and Room found that the arrest rates for cannabis users who had used the drug in the past year are roughly 3 percent, and that none of those convicted of possession is incarcerated or receives an administrative fine of more than $1000 US dollars.[98,99,100]

Finally, it is important to note that despite media accounts, no country has legalized cannabis and no country has proposed legalization for discussion at the Commission on Narcotic Drugs. Several countries have removed formal penalties for small amounts of personal use and only in two countries have there been any formal changes in the criminal status of supplying cannabis (though these have fallen short of full legalization).

Non-enforcement of Cannabis Use and Possession

Several countries and particular regions in certain countries (e.g. some U.S. states, some areas in Germany, etc.) have regulations that formally do not enforce laws against cannabis use and possession.

The most cited example of alternative cannabis laws comes from the Netherlands. Indeed, there has been much research on the Dutch cannabis laws. In 1976, the Dutch approved a formal policy to allow the possession and sale of up to about ninety cannabis cigarettes (thirty grams). The government allowed "coffee-shops" selling cannabis to appear around the country and approved in 1980 guidelines allowing more local control discretion of commercial cannabis practices. As the Dutch got used to the idea of legal cannabis, coffee shops increased in prevalence and the number of them grew eleven-fold in eight years (nine in 1980 and 102 by 1988).[101] In 2001, a lower-end estimate numbers coffee shops at about 1,200.With

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[97]Beau Kilmer, Jonathan P. Caulkins, Rosalie Liccardo Pacula, Robert J. MacCoun, Peter H. Reuter, Altered State? Assessing How Cannabis Legalization in California Could Influence Cannabis Consumption and Public Budgets, RAND, 2010.

[98] Kilmer, Beau, "Do Cannabis Possession Laws Influence Cannabis Use?" in I. Spruit, ed., *Cannabis 2002*
Report: Technical Report of the International Scientific Conference, Brussels: Ministry of Public Health of
Belgium, 2002, pp. 119–141.

[99] Room, Robin, Benedikt Fischer, Wayne Hall, Simon Lenton, and Peter Reuter, *Cannabis Policy: Moving*
Beyond Stalemate, Oxford, UK: Oxford University Press, 2010.

[100]Pacula, Rosalie L., Robert MacCoun, Peter Reuter, Jamie Chriqui, Beau Kilmer, Katherine Harris, Letizia Paoli, and Carsten Schäfer, "What Does It Mean to Decriminalize Cannabis? A Cross-National Empirical Examination," in Björn Lindgren and Michael Grossman, eds., *Advances in Health Economics and HealthServices Research*, Vol. 16: *Substance Use: Individual Behaviour, Social Interactions, Markets and Politics*, Amsterdam: Elsevier Press, 2005, pp. 347–370.

[101] Jansen, A.C.M. (1991). *Cannabis in Amsterdam: A geography of hashish and cannabis*. Muiderberg, Netherlands: Coutinho.

the exception of the toleration of coffee shops, however, the Netherlands is not in favor of legalizing marijuana.[102]

MacCoun and Reuter point out that between 1976 and 1984, cannabis use remained about the same for adults and youth. Thus the early effect of this policy change seemed to have been minimal. From the mid-1980s to the mid-1990s, though, they observe that "surveys reveal that the lifetime prevalence of cannabis in Holland increased consistently and sharply." They report 15 percent of 18-20 year olds used cannabis in their lifetime in 1984 turned into 44 percent by 1996 – a 300 percent increase. Indeed, they also find cite past-month prevalence of 8.5 percent in 1984 to 18.5 percent in 1996. MacCoun and Reuter point to "commercialization" as the reason for this spike in drug use. That is, they contend that during this period between 1984 and 1996, the greater glamorization and more visible promotion of cannabis lead to an increase in use. Others, like Sabet, suggested that the increase could also be due in part to a greater normalization of use, as anti-drug attitudes eroded among youth and use became more gradually accepted.[103] The discussion of prevalence rates in the Netherlands is a subject of active debate.[104]

There has been a recent shift in policy in the Netherlands. The government continues to reduce the number of coffee shops, and today the number stands at approximately 700. That means that there is one coffee shop for every 29,000 Dutch citizens – although the concentration in the city of Amsterdam is closer to one for every 3,000 people.[105] Current cannabis use in the Netherlands is similar to other European countries but treatment admissions for cannabis are higher in that country than other European neighbors.[106] Severe restrictions by the Dutch government have been implemented, including allowing only Dutch citizens to buy cannabis from the coffee shops and continuing to zone areas forbidding coffee shops altogether.

Depenalisation

Other countries (e.g. the Czech Republic, Italy, Spain, and Azerbaijan) have decriminalized the personal use and possession of all illicit drugs. The most cited example of depenalization is Portugal.That country's law,which came into effect in 2001, allows people to possess up to an average of "ten days" supply for personal consumptionof any illicit drug, and refers cases of possession of between three and ten days' supply to an administrative panel that makes recommendations for treatment and/or monetary sanctions. Trafficking and cultivation of illicit substances,

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[102] MacCoun, R. & Reuter, P. (2001). *Drug War Heresies: Learning from Other Vices, Times and Places*. New York: Cambridge University Press.

[103] Sabet, K. (2006). The (often unheard) case against cannabis leniency. In *Pot Politics* (Ed. M. Earleywine).Oxford University Press, pp. 325-355.

[104] See, for example, Abraham, M.D. et al. (2001). Comparative cannabis use data. British Journal of Psychiatry, 179: 175-177, accessed November 2011: http://bjp.rcpsych.org/content/179/2/175.3.full

[105] MacCoun, R. J. (2011), What can we learn from the Dutch cannabis coffee shop system?. Addiction, 106: 1899–1910.

[106] MacCoun, R. J. (2011), What can we learn from the Dutch cannabis coffee shop system?. Addiction, 106: 1899–1910.

as well as possession of quantities exceeding a ten days' supply, remain criminal offenses.

Ten years later, there has been a surprisingly few number of rigorous analyses on the policy change. An analysis by the libertarian Cato Institute declared the Portuguese experiment an unequivocal success, citing reductions in drug-related deaths and no major increases in drug use among youth.[107] This attracted wide publicity in the mainstream media, although the United States government, for example, publicly questioned these findings, stating that the report's analysis was not definitive; that the report failed to recognize other factors that could have contributed to its findings; that adverse data was not reported in the study, and that claims that drug use went down were inconclusive.[108]

A thorough report in 2011 by the European Monitoring Center for Drugs and Drug and Addiction (EMCDDA) presented a more nuanced picture.[109] EMCDDA concluded that Portugal's drug policy of depenalisation is not a "magic bullet" and that "the country still has high levels of problem drug use and HIV infection, and does not show specific developments in its drug situation that would clearly distinguish it from other European countries that have a different policy."[110]

Mexico also does not consider the possession of drugs, up to a certain amount, as a criminal offense. In Mexico in 2009, the federal government published a decree in its official federal record thatdefined maximum quantities of illegal drugs that may be considered for personal use (e.g. 5 grams for marijuana), and specified non-criminal procedures, including treatment referral, to be followed when a person is found in possession of personal use quantities of illegal drugs.[111]The law also puts an end to conflicting definitions of possession for personal consumption that had existed among various Mexican courts and had made it possible for a court to find that even large amounts of drugs were for "personal consumption."The large scale drug possession crimes remain exclusively a federal crime.

Countries with a mix of policies

Some countries have a mixture of policies, depending on region and political will. For example, the United States outlawed cannabis on a federal level in 1937, with the

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[107] Greenwald, G. (2009). Drug Decriminalization in Portugal: Lessons for Creating Fair and Successful Drug Policies. Cato Institute.

[108] White House Office of National Drug Control Policy. (2010). *Drug Decriminalization in Portugal: Challenges and Limitations.* Accessed November 2011 at http://www.whitehouse.gov/sites/default/files/ondcp/Fact_Sheets/portugal_fact_sheet_8-25-10.pdf

[109] European Monitoring Center for Drugs and Drug and Addiction. (2011). *Drug Policy Profiles-Portugal*. Accessed November 2011 at http://www.emcdda.europa.eu/publications/drug-policy-profiles/portugal

[110] European Monitoring Center for Drugs and Drug and Addiction. (2011). *Drug Policy Profiles-Portugal*. Accessed November 2011 at http://www.emcdda.europa.eu/publications/drug-policy-profiles/portugal, page 24.

[111] Avilés Allende, C. (2009). Adictos son enfermos, no criminales: Corte. *El Universal.* Mexico City.

passage of the Marihuana Tax Act, but today several states have formal depenalisation laws. Indeed, in the 1970s, twelve states formally depenalised cannabis. This meant that persons found to have a small amount of cannabis were not subject to jail time, but rather they would receive a civil penalty, such as a fine. The discussion in the United States is highly complex because even in jurisdictions without a formal depenalisation law, persons are rarely jailed for possessing small amounts of cannabis. A rigorous government analyses of who is in jail or prison for cannabis found that less than 0.7% of all state inmates were behind bars for cannabis possession only (with many of them pleading down from more serious crimes).[112] Other independent research has shown that the risk of arrest for each "joint," or cannabis cigarette, smoked is about 1 arrest for every 12,000 joints.[113] This probably explains the fact that the literature on early depenalisation effects on use has been mixed. Some studies found no increase in use in the so-called depenalisation' states, whereas others found a positive relationship between greater use and formal changes in the law.[114]

The more recent discussion about state-level legalization may provide more insights. Two RAND Corporation reports provide a useful analysis of such a policy. The studies concluded that legalization would result in lower cannabis prices, and thus increases in use (though by how much is highly uncertain), and that "legalizing cannabis in California would not dramatically reduce the drug revenues collected by Mexican drug trafficking organizations from sales to the United States."[115]

Cannabis for Medicinal Purposes

Over the past two decades, the idea of cannabis as medicine has become increasingly popular. Citizens of several U.S. states, beginning in 1996, voted by referenda to allowed the use of"medical" cannabis. Countries such as Austria, Canada, Finland, Germany, Israel, Portugal and Spain also have some form of "medical" cannabis regulation. This section provides a very brief synopsis of the current situation.

First, it is important to distinguish between the whole cannabis plant material and individual components within the cannabis plant. Some constituents of cannabis, including THC, are available today in pill form (dronabinol, or Marinol®); some

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[112]"Substance Abuse and Treatment, State and Federal Prisoners, 1997." BJS Special Report, January 1999, NCJ 172871. http://www.ojp.usdoj.gov/bjs/pub/pdf/satsfp97.pdf

[113] Beau Kilmer, Jonathan P. Caulkins, Rosalie Liccardo Pacula, Robert J. MacCoun, Peter H. Reuter, Altered State? Assessing How Cannabis Legalization in California Could Influence Cannabis Consumption and Public Budgets, RAND, 2010.

[114] For a discussion see MacCoun, R., Pacula, R. L., Reuter, P., Chriqui, J., Harris, K. (2009). Do citizens know whether they live in a decriminalization state?State cannabis laws and perceptions. *Review of Law & Economics, 5(1),* 347-371.

[115]Beau Kilmer, Jonathan P. Caulkins, Rosalie Liccardo Pacula, Robert J. MacCoun, Peter H. Reuter, *Altered State? Assessing How Cannabis Legalization in California Could Influence Cannabis Consumption and Public Budgets*, RAND, 2010.Andsee Kilmer, Beau , Jonathan P. Caulkins, Brittany M. Bond and Peter H. Reuter. *Reducing Drug Trafficking Revenues and Violence in Mexico: Would Legalizing Cannabis in California Help?*.Santa Monica, CA: RAND Corporation, 2010. http://www.rand.org/pubs/occasional_papers/OP325. Also available in print form.

synthetic mimics of those constituents are also available (nabilone, or Cesamet®; see Table 1 for a list of active metabolites).

Table 1 Active Metabolites in Cannabis[116]

Delta-9-Tetrahydrocannabinol (THC)
Cannabidiol
Cannabigerol
Cannabinol
Olivetol

The whole cannabis plant material, on the other hand, has thousands of unknown and carcinogenic components that have not been accepted by scientific and medical authorities as medicines. Certainly, medicines are never smoked, and an exhaustive review in 1999 by the United States Institute of Medicine concluded that smoked cannabis should "generally not be recommended for medical use."[117]Additionally, smoked cannabis has a variation of effective dose, due to individual differences in absorption and metabolism in the liver, as well as puff frequency, depth of inhalation, and retention of inhaled smoke.[118]

Though the whole cannabis plant is not medicine, several governments including Canada, the United States, the United Kingdom, the Czech Republic, Spain, and other European countries have robust research programs to determine the medical efficacy of some of the constituents within cannabis. In some of these countries, cannabis-based medicines have been approved to treat neuropathic pain related to cancer and spasticity related to Multiple Sclerosis (MS). These products include nabiximols (Sativex®), an oromucosalspray comprised of THC and another cannabinoid, cannabidiol (CBD), which allows for proper titration of dosage, eliminates the major health consequences of inhaling smoke and tends to lessen the intoxicating effects of THC.

Constituents of cannabis have been cited as helpful for some medical conditions, though the evidence is scarce when compared to sample size and length of studies required for new drug approval.Cannabis constituents have shown promise in studies relating to multiple sclerosis, pain, glaucoma, and as an anti-nausea drug for patients undergoing chemotherapy.These studies, however, have lacked standardization of the active ingredients, and have used small sample sizes and a variety of administration routes.New drug approval requires standardization in purity, potency, and quality, and multiple controlled clinical trials.[119, 120]

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[116] Williamson EM & Evans FJ (2000). Cannabinoids in clinical practice. *Drugs, 60*(6):1303-1314.
[117] Joy, J. E., Waston, S. J., & Benson, J. A. (Eds.). (1999). *Marijuana and medicine: Assessing the science base.* Washington, DC: National Academy Press.
[118] Gorelick, DA & Heishman, SJ (2006). Methods for clinical research involving cannabis administration.In *Methods in Molecular Medicine: Marijuana and Cannabinoid Research: Methods and Protocols* (Ed. E. S. Onaivi). New Jersey: Humana.
[119] Williamson, EM & Evans, FJ (2000). Cannabinoids in clinical practice. *Drugs, 60*(6):1303-1314.
[120] American Society of Addiction Medicine, *ASAM Medical Marijuana Task Force White Paper*, 2011.

It is important to distinguish between users of scientifically-approved, legitimate cannabis-based medications and those who seek to use "medical" cannabis as a shield for legitimizing general cannabis use. A 2007 study analyzing over 3,000 "medical cannabis users in California, found that an overwhelming majority (87.9%) of those queried about the details of their cannabis initiation had tried it before the age of 19, and the average user was a 32-year-old white male. 74% of the Caucasians in the sample had used cocaine, and over 50% had used methamphetamine in their lifetime.[121] According to a 2011 study in the Journal of Drug Policy Analysis that examined 1,655 applicants in California who sought a physician's recommendation for medical cannabis, very few of those who sought a recommendation had cancer, HIV/AIDS, glaucoma, or multiple sclerosis.[122] Additionally, in the US state of Colorado, according to the state Department of Health, only 2% of users reported cancer, and less than 1% reported HIV/AIDS as their reason for cannabis. The vast majority (94%) reported "severe pain."[123] Finally, in Oregon, there are reports that only 10 physicians made half of all recommendations for "medical" cannabis[124], and agitation, seizures, cancer, HIV/AIDS, cachexia, and glaucoma were the last six reasons people utilized cannabis for "medical" purposes.[125] The use of cannabis under the guise of medicine has also affected youth drug use patterns. A study by researchers at Columbia University looked at two separate datasets and found that residents of states with "medical" cannabis had cannabis abuse/dependence rates almost twice as high than states without such laws.[126] Another study in the Annals of Epidemiology found that, among youths age 12 to 17, cannabisusage rates were higher in states with medical cannabis laws (8.6%) compared with those without such laws (6.9%).[127] More research on this connection is needed.

Synthetic cannabinoids, also known as "K2" or "Spice" are emerging as a new drug of abuse.These products are mixtures of herbs and spices that are sprayed with any number of synthetic compounds chemically similar to THC.Synthetic cannabinoids are often purchased in tobacco or head shops, or over the internet, and is typically

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[121]O'Connell, T and Bou-Matar , C.B. (2007). Long term cannabis users seeking medical cannabis in California (2001–2007): demographics, social characteristics, patterns of cannabis and other drug use of 4117 applicants. Harm Reduction Journal,http://www.harmreductionjournal.com/content/4/1/16

[122]Nunberg, Helen; Kilmer, Beau; Pacula, Rosalie Liccardo; and Burgdorf, James R. (2011) "An Analysis of Applicants Presenting to a Medical Cannabis Specialty Practice in California," Journal of Drug Policy Analysis: Vol. 4: Iss. 1, Article 1. Available at: http://www.bepress.com/jdpa/vol4/iss1/art1

[123] See Colorado Department of Public Health, http://www.cdphe.state.co.us/hs/medicalcannabis/statistics.html

[124]See for example, Danko, D. (2005). Oregon Medical Cannabis Cards Abound, The Oregonian, January 23, 2005.Also see Oregon Medical Cannabis, Protect the Patients & Treat it Like Medicine, http://www.oregon.gov/Pharmacy/Imports/Cannabis/Public/ORStatePolice_OMMALegPP.pdf?ga=t

[125] Oregon Medical Cannabis Program Statistics, http://public.health.oregon.gov/diseasesconditions/chronicdisease/medicalcannabisprogram/pages/data.aspx

[126] Cerda, M. et al. (2012). Medical cannabis laws in 50 states: investigating the relationship between state legalization of medical cannabis and cannabis use, abuse and dependence. *Drug and Alcohol Dependence*. ;120(1-3):22-7.

[127] Wall, M. et al (2011). Adolescent Cannabis Use from 2002 to 2008: Higher in States with Medical Cannabis Laws, Cause Still Unclear, *Annals of Epidemiology, Vol* 21 issue 9 Pages 714-716.

smoked.Affects are similar to those of marijuana, but a lack of standardization of synthetic ingredients make them particularly dangerous, as users often do not know what they are inhaling.[128]

While the research is in early stages, there may be evidence of cannabinoid receptor antagonists in the treatment of psychotic disorders and schizophrenia.These compounds inhibit the reuptake of anandamide, and recent studies suggest that these novel drugs exhibit similar pharmacological profiles to atypical antipsychotic drugs currently on the market.[129]

Conclusions

Recent data on smoking cannabis clearly shows that it is unhealthy and dangerous. Cannabis use is linked to addiction, cognitive impairment, motor skills deficiency, respiratory, cardiovascular and mental health problems, and it has been shown to be particularly damaging to maturing brains. The international experience with increased emergency room admissions and treatment entrants represent the dangerousness of today's highly potent cannabis, and its potential to greatly threaten both the public health and public safety. On the other hand, components of cannabis have been found to be effective for a few medical reasons, and research in this area is ongoing. Despite some increased calls for depenalisation or "soft-drug" labeling, Member States of the Commission on Narcotic Drugs have not raised the subject in this formal setting, and cannabis possession should remain a punishable offence, while its use should be prevented and its continued use treated. There are several evidence-based prevention and treatment strategies that governments can implement to effectively reduce marijuana use, abuse and addiction and prevent much of the consequences and costs to society with regard to health care, social support, security and development.

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[128] United States Drug Enforcement Administration, *Drug Fact Sheet: K2 or Spice*, 2011.

[129] Roser P, Vollenweider FX, Kawohl W (2010).Potential antipsychotic properties of central cannabinoid (CB1) receptor antagonists. *The World Journal of Biological Psychiatry*, 11(2):208-219.