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Marijuana Addictive Disorders and DSM-5 Substance-Related Disorders

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Abstract

Marijuana addiction often is questioned, debated and dismissed as beneficial, not addicting and without serious adverse effects. However, examining the evidence derived from clinical practice and scientific research as illustrated and validated in the diagnostic criteria in the Diagnostic and Statistical Manual, fifth edition, (DSM-5), marijuana is highly addicting, harmful and dangerous as other drugs of addiction.

Keywords: Marijuana; Addictive disorders; Psychiatry; Cannabis use; *Cannabis sativa*

Purpose

This summary presents a factual, research based clinical framework for diagnosis of marijuana addiction based on years of development of the Diagnostic and Statistical Manual [1]. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, DSM-5, provides the standard nomenclature for diagnosis of marijuana addiction in Substance Related and Addictive Disorders. DSM-5 is a systematic, evidenced based approach to diagnosis that includes empirically demonstrated reliability in field trials conducted over 12 years. The results were evaluated by public and professional review, expert review, scientific review committee for peer review process, clinical and public health committee, council on psychiatry and the law. Further, DSM-5 was harmonized with the International Classification of Diseases (ICD system), which universally accepted coding system [2].

Introduction

Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5), Substance-Related and Addictive Disorders: Cannabis Use Disorders The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, DSM-5, provides the standard nomenclature for diagnosis of marijuana addiction in Substance Related and Addictive Disorders [1]. DSM-5 is a systematic, evidenced based approach to diagnosis that includes empirically demonstrated reliability in field trials. The results were evaluated by public and professional review, expert review, scientific review committee for peer review process, clinical and public health committee, council on psychiatry and the law. Further, DSM-5 was harmonized with the International Classification of Diseases (ICD system), which universally accepted coding system [1,2].

DSM-5 is a well-recognized and accepted manual for reliable diagnoses essential for guiding treatment, identifying prevalence rates for mental disorders for clinical and basic research, and documenting important public health information, such as morbidity and mortality rates. DSM-5 provides consistent, strong, and objective scientific validation of Substance-Related and Addictive Disorders, specifically Cannabis Use Disorders. The term, marijuana, is preferentially used in lieu of cannabis, as marijuana describes the popular name for the drug consumed by the public, and "medical marijuana". However, marijuana is equivalent to cannabis in the nomenclature in virtually every respect. Cannabis is the scientific name for *Cannabis sativa*, the plant from which marijuana is cultivated [3-5].

DSM-5 is based on a cooperative agreement with the American Psychiatric Association (APA), the World Health Organization (WHO), the National Institute of Mental Health (NIMH), National Institute of Drug Abuse (NIDA), National Institute of Alcoholism and Alcohol Abuse (NIAA) to plan and develop DSM-5. DSM-5 is an intensive 6 year process which involved conducting literature reviews and secondary analyses, publishing reports research reports in scientific journals, developing draft diagnostic criteria, posting preliminary drafts on the DSM-5 Web site for public comment, presenting preliminary findings at professional meetings, performing field trials and revising criteria and text [1].

For DSM-5, field trials were extended by using two distinctive designs: one large, diverse medical-academic settings, and the other routine clinical practices. The former capitalized on the need for large sample sizes to test hypotheses on reliability and clinical utility of diagnoses, and the latter supplied valuable information on how proposed revisions performed in every day clinical settings in diverse populations. The medical-academic field trials were conducted at 11 North America medical-academic sites and assessed the reliability, feasibility, and clinical utility of select revisions, with priority having the greatest public health impact [1] (Table 1).

Cannabis Use (Marijuana Use) Disorders According to DSM V	
Consequence	**Definition/Symptoms**
Cannabis Use Disorder	A problematic pattern of cannabis use leading to clinically significant impairment or distress as manifested by at least two of the following occurring in a 12 month period:
	1. Cannabis is often taken in larger amounts over a longer period than was intended.
	2. There is a persistent desire or insignificant effort to cut down or control cannabis use.
	3. A great deal of time is spent in activities necessary to obtain cannabis, use cannabis or recover from its effects.
	4. Craving or a strong desire or urge to use cannabis.
	5. Recurrent cannabis use resulting in failure to fulfill major role obligations at work, school or home.
	6. Continued cannabis use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of cannabis.
	7. Important social, occupational or recreational activities are given up or reduced because of cannabis use.
	8. Recurrent cannabis use in situations which is physically hazardous.
	9. Cannabis use is continued despite knowledge of having persistent or recurrent physical or psychological problems that are unlikely to have been caused or exacerbated by cannabis.
	10. Tolerance, as defined by either:
	1) A need for markedly increased amounts of cannabis to achieve intoxication and desired effect, or
	2) A markedly diminished effect with continued use of the same amount of cannabis.
	11. Withdrawal, as manifested by either:
	1) The characteristic withdrawal symptoms for cannabis, or
	2) A closer related substance is taken to relieve or avoid withdrawal symptoms.
Cannabis Intoxication	1. Recent use of cannabis.
	2. Clinically significant problematic behavior or psychological changes (e.g. impaired motor coordination, euphoria, anxiety, sensation of slowed time, impaired judgment, social withdrawal) that develop during, or shortly after, cannabis use.
	3. Two or more of the following signs or symptoms developing within two hours of cannabis use:
	1) Conjunctival injection
	2) Increased appetite
	3) Dry mouth
	4) Tachycardia
	4. The signs or symptoms are not attributable to another medical condition and are not better explained by another mental disorder, including intoxication with another substance.
Cannabis Withdrawal	1. Cessation of cannabis use that has been heavy and prolonged (i.e., usually daily or almost daily over a period of at least a few months)
	2. Three or more of the following signs and symptoms develop within approximately one week after cessation of heavy, prolonged use:
	1) Irritability, anger or aggression
	2) Nervousness or anxiety
	3) Sleep difficulty (e.g. insomnia, disturbing dreams)

	4) Decreased appetite or weight loss
	5) Restlessness
	6) Depressed mood
	7) At least one of the following physical symptoms causing significant discomfort:
	i. Abdominal pain,
	ii. Shakiness/tremors,
	iii. Sweating,
	iv. Fever,
	v. Chills, or
	vi. Headache
	3. The signs or symptoms cause clinically significant distress or impairment in social, occupational or other important areas of functioning.
	4. The signs and symptoms are not attributable to another medical condition and are not better explained by another mental disorder, including intoxication or withdrawal from another substance.
Cannabis-Induced Mental Disorder	1. Affective Disorders
	a. Anxiety Disorders
	b. Depression
	c. Bipolar Disorder
	2. Schizophrenia
	3. Amotivational Syndrome
	4. Disruptive Cognitive Function
	5. Neuropsychological decline
	6. Psychotic Disorders
Cannabis-Induced Physical Disorder	1. Lung Damage
	2. Heart Disease
	3. Cancer
	4. Pregnancy Complications

Table 1: DSM-5 cannabis use and addictive disorders.

Cannabis use disorder (Addictive disorder)

The DSM-5 Cannabis Use Disorder (Addictive Disorder) provides 11 criteria to identify a problematic pattern of cannabis use leading to clinically significant impairment or distress as manifested by at least two of the 11 criteria occurring in a 12 month period. Criteria 1-9 represent the behavioral patterns for addictive use of marijuana. These behavioral criteria represent the loss of control over the use of marijuana with adverse consequences over a period, and recurrent pattern of problematic cannabis use. Criteria 10 and 11 represent the pharmacological phenomena of tolerance and dependence.

While specific diagnoses for DSM Cannabis Use Disorders do not contain the terminology, "addiction", they are classified within the DSM diagnostic category "Addictive Disorders". In addition, the 11 criteria for Cannabis Use Disorder are subsumed under an accepted definition for addiction for purposes of conceptualizing marijuana addiction: 1) a preoccupation with acquiring the drug or substance, 2) compulsive use which is continued use despite adverse consequences, and 3) a pattern of loss of control or an inability to refrain from relapse or recurrence of adverse consequences from the drug use. Pervasive to all three criteria is an impaired or loss of control despite harmful or adverse effects. These criteria form the basis of the criteria in DSM-5 criteria for Cannabis Use Disorders, (Substance-Related and Addictive Impaired or loss of control is represented by Criteria, 1, 2, 3, 4 and social impairment (due to loss of control) is represented by criteria 5, 6, 7 and high risk use (loss of control) by criteria 8, 9 and pharmacological tolerance and dependence by criteria 10, 11.

Criterion 1: Cannabis is often taken in larger amounts over a longer period than was intended (loss of control). Individuals with cannabis use disorders may use throughout the day over a period of months to years, and may spend many hours a day under the influence. Others may use less frequently but with adverse consequences from their

cannabis use. Periodic cannabis use and intoxication can negatively affect behavioural and cognitive functioning and interfere with performance at work or school, place the individual at increased physical risk when performing activities such as driving or working with devices or machinery.

Criterion 2. There is a persistent desire or insignificant effort to cut down or control cannabis use (loss of control). While it is hard to get an addict to admit they want to quit or made a serious effort to quit, many regular users addicted to marijuana do find abstinence difficult, and represents preoccupation with using and acquiring marijuana.

Criterion 3. A great deal of time is spent in activities necessary to obtain cannabis, use cannabis, or recover from its effects, and represents preoccupation with acquiring and using marijuana and compulsive use from adverse use in prolonged withdrawal.

Criterion 4. Craving or a strong desire or urge to use cannabis, which is often not conscious and reflects a preoccupation with acquiring and using marijuana.

Criterion 5. Recurrent cannabis use resulting in failure to fulfil major role obligations at work, school or home and illustrates compulsive use or use despite adverse consequences.

Criterion 6. Continued cannabis use despite having persistent or recurrent social or iterpersonal problems caused or exacerbated by the effects of cannabis and illustrates compulsive use or use despite adverse consequences.

Criterion 7. Important social, occupational, or recreational activities are given up or reduced because of cannabis use and illustrates compulsive use or use despite adverse consequences.

Criterion 8. Recurrent cannabis use in situations which is physically hazardous and illustrates compulsive use or use despite adverse consequences.

Criterion 9. Cannabis use is continued despite knowledge of having persistent or recurrent physical or psychological problems that are unlikely to have been caused or exacerbated by cannabis illustrates compulsive use or use despite adverse consequences.

Criterion 10. Tolerance, as defined by either: a need for markedly increased amounts of cannabis to achieve intoxication and desired effect or a markedly diminished effect with continued use of the same amount of cannabis.

Pharmacological tolerance is an expected consequence of regular, repetitive use of marijuana.

Criterion 11. Withdrawal, as manifested by either: The characteristic withdrawal symptoms for cannabis, or cannabis or a closely related substance is taken to relieve or avoid withdrawal symptoms. Pharmacological withdrawal is common with regular repetitive use.

Tolerance and dependence frequently accompany addictive use of drugs, in this instance, marijuana. However, they are not specific to addictive use and can occur independently of marijuana addiction. Tolerance (pharmacological) is the need to use more marijuana due to the adaptation of the brain to the presence of marijuana. Dependence (dependence) is the expression of withdrawal effects from the deadaptation due to discontinuation of marijuana [3-6].

Severity of the Cannabis Use Disorder is dependent on the number of criteria in each assessment: Mild: Presence of 2-3 symptoms, Moderate: Presence of 4-5 symptoms, Severe: Presence of 6 or more symptoms.

Factors determining addiction: Vulnerability, addiction potential, availability, potency

The onset of addiction consists of vulnerability to drug addiction, namely factors such as genetic predisposition, and sensitivity of reward centers in the brain, located in the mesolimbic system, that predisposes an individual to developing repetitive, compulsive marijuana use [7-11]. Availability of marijuana is determined by many factors that are environmental, laws, illicit distribution and more recently a framework of state created "medical marijuana"[4,5,8]. Addiction potential and potency of marijuana determine probability and strength of addiction to marijuana.

Genetic predisposition to marijuana addiction

As with addiction to other drugs and alcohol, risk for marijuana addiction is dependent on genetic predisposition [8-11]. One study showed that 50%-60% of drug addiction is due to genetic factors [4,8]. Further, the offspring of an addict is 8 times more likely to develop a drug addiction [6]. While these studies focused on drug addiction in general, studies have illustrated substantial evidence for the heritability of cannabis use, abuse, and dependence. It is likely that the genetic predisposition is related to the CNR1 gene, which codes for CB1, the main cannabinoid receptor in the brain. The CNR1 gene is crucial for generating the rewarding effects of the compound responsible for the psychoactive effects associated with cannabis use [9,10].

Marijuana (*Cannabis sativa*) typically used illicitly or as "medical marijuana," contains over 400 cannabinoids, which have diverse effects in the brain and on behaviors that act on CB1 and CB2 cannabinoid receptors found throughout the central nervous system [3-5]. Endogenous cannabis ligands and receptors, behaving essentially as neurotransmitters and neurotransmitter receptors, participate in the addictive use of marijuana. The same mesolimbic system that underlies addictive use to alcohol and other drugs is a common pathway for addictive use of marijuana. Dopamine and endogenous cannabinoid system function in the reward system to promote the preoccupation, compulsion, or relapse to the use of marijuana [3,4].

Addiction Potential

The addiction potential of drugs is based on the inherent capacity of the drug to affect centers in the brain responsible for addictive drives, and the potency of the drug itself. The criteria for addiction potential are often based on withdrawal, reinforcement, tolerance, dependence and intoxication. The rankings therefore are heavily weighted by the physiological manifestation of tolerance, dependence and withdrawal. Whereas the stronger indicator for addictive use is behavioral (e.g. preoccupation), compulsive use and relapse. Addiction to marijuana is manifested more by the behavioural phenomena or Criteria 1-9 in DSM-5. The higher potency preparations for "medical marijuana" increase the addiction potential [3,6]. Such preparations show more measurable physiological effects, such as intoxication, reinforcement and withdrawal. Nicotine addiction is similar to marijuana addiction as it involves more behavioural changes. Conversely, heroin addiction has much greater withdrawal effects. However, even withdrawal from heroin is mostly behavioral and subjective as the vital signs are normal without seizures or delirium as in alcohol withdrawal. The addiction potential to nicotine is highly evident in the compulsive use as 480,000

people die a year from nicotine addiction [12]. And marijuana as the commonly used illicit or licit "drug" second to alcohol in the world (preoccupation) reflects high addiction capacity [4,6].

Availability of marijuana

Epidemiological assessments that show cannabis is a commonly used drug, either illicit reflects its availability. The rise in marijuana use and addiction has been dramatic particularly over the last 10-20 years [3,8,10]. Government measures to limit marijuana availability have not had a large impact and, in fact, have expanded availability. Alleged "medical marijuana" has been a leading source of increased availability through public initiated legislative declarations that marijuana has presumed effective therapeutic and analgesic effects.

Potency of marijuana

The potency of marijuana (cannabis) that is generally available varies greatly, ranging from 1% to approximately 50% in typical cannabis plant material and 10%-20% in hashish [3,4]. During the past two decades a steady increase in the potency of seized cannabis has been observed in illicit and "medical marijuana" to increase its attractiveness and risk of addiction [12].

The potency of smoked "medical marijuana" has multiplied due to increasing concentrations of THC from the plant preparations, grown by "caregivers" and "dispensaries" [4]. The plant preparations today are able to achieve high concentrations of THC between 20%-50%. Decades ago the THC concentration was less than 5% as the psychoactive component found in marijuana which resulted in more mellow effects and less toxicity. However, because of the increased availability and potency of THC in "home gown" medical and "unrestricted" illicit marijuana, previously safer use is diminishing and significantly less achievable [3,12].

Cannabis intoxication

Cannabis intoxication may be obvious or subtle and may be confirmed via objective testing, e.g. clinical evaluation and laboratory testing. Also, cannabis intoxication occurs in the presence of other drugs so that a comprehensive assessment is often indicated. A review of the level of functioning in all spheres of life events is necessary to examine the effects of persistent cannabis intoxication: Agitation, Ataxia, impairment in memory and executive functioning, hyperkinesis or lethargy, bronchospasms, coma, paranoia [3,4,6].

Cannabis withdrawal

While the existence of cannabis withdrawal is disputed, its occurrence can be confirmed particularly in regular and frequent users with proper assignment of the causal effects of marijuana. Again, withdrawal effects from concurrent use of other drugs should be considered "syndrome". More than 50% of regular users are experiencing withdrawal symptoms. Symptoms of marijuana withdrawal are consistent of: anxiety, depression, decreased appetite, headaches, insomnia, irritability, muscle tension, nausea, nightmares and unpleasant vivid dreams [3,4,7].

Cannabis-induced mental disorders

DSM V also provides a diagnostic category to account for marijuana-induced mental disorders. Common mental disorders induced by marijuana includes anxiety, depression, personality changes

and psychosis [3,4,6]. These marijuana-induced mental disorders are potentially severe, temporary, though sometimes persisting central nervous syndromes that develop in the context of prolonged use of marijuana [7,15]. These marijuana induced mental disorders are distinguishable from substance use disorders or marijuana use disorder or from other mental disorders in that they are often transient and resolve with the discontinuation of marijuana and the treatment of the marijuana use disorder [6,11,16].

Between 50% and 90% of cannabis-dependent persons are diagnosed with affective disorder, suicidality and anxiety disorder. Also, cannabis use, particularly in adolescence, is associated with high rates of schizophrenia where either the cannabis has reversibly induced psychotic symptoms consistent with schizophrenia or has triggered the onset of schizophrenia or where there is a high rate of marijuana use among those diagnosed with schizophrenia [17,18].

Importantly, regular cannabis use and depression occur together, more often than what we would expect by chance, and is likely drug induced. The amotivational syndrome, which was previously described, is a direct result of regular heavy cannabis use in which there is an increase in apathy and decrease in capacity for usual activities required for achievement and success [6,18].

Many studies now show that marijuana in the short and long term significantly disrupts cognitive function; decreasing IQ significantly [1]. Neurological testing was conducted at the age of 13 before the initiation of cannabis use and again at the age of 38 after a pattern of persistent cannabis use had developed. Persistent cannabis use was associated with neuropsychological decline broadly across domains of IQ functioning, even after controlling for years of education [18].

Studies have showed that in 1,200 college freshmen over a 10 year period that marijuana use contributed to college students skipping more classes, spending less time studying, earning lower grades, dropping out of college, and being unemployed after college [19]. On average, marijuana increases the risk of having academic problems.

MRI studies of the brain showed that marijuana users had significantly less bilateral orbital-frontal gyri volume, higher functional conductivity in the orbital frontal cortex (OFC) network and tracks that innervate the OFC as measured by fractional anisotropy [20]. OFC functional connectivity and marijuana users were associated with early onset age of onset [21].

Cannabis-induced physical disorders

Smoking marijuana causes severe lung damage equal to and similar to that caused by smoking tobacco [22]. There may be some brief short-term bronchial dilation. The long-term effects greatly negate any minor positive effects. The use of cannabis increases the risk of heart attack. It causes ischemia by a five-fold increase in blood carboxyhemoglobin, which interferes with the hemoglobin's ability to transport oxygen. It also increases the heart rate dramatically, 40 beats per minute or more. Cannabis is carcinogenic [23,24]. It is associated with brain gliomas, prostate and cervical cancers. Cannabis use during pregnancy leads to delays in neurological development [25]. The babies born to women who used cannabis respond differently to stimuli, have higher-pitched cry, and tremble more. Further research suggests that THC is extruded in the breast milk in moderate amounts [26].

Selected Topics for Marijuana Addictive Disorder

In addition to the established documentation from clinical experience, scientific literature and field trials, the essential features of addictive use of marijuana, namely, preoccupation with acquiring, compulsive use and relapse are readily apparent in objective assessments derived from a focused review of the medical and scientific literature [6].

Preoccupation

Prevalence

Prevalence for use and dependence (addiction) to marijuana is frequent and widespread, and is indicative of preoccupation as in addictive use [27].

In the US, an estimated 17% of past year marijuana users age 12 and older used marijuana on 300 or more days within the past 12 month [12,28]. This means that almost 5.4 million people used marijuana on a daily or almost daily basis over a 12 month period. An estimated 40.3% or 7.6 million current marijuana users age 12 and older used marijuana on 20 or more days in the past month [12,28]. These criteria in aggregate and individually confirm a strong preoccupation with acquiring and using marijuana as in addictive use.

Epidemiological studies in US indicate that the past year prevalence of marijuana use was 9.5% in 2012 to 2013 [27]. A significant increase over the prevalence in 2001 to 2002, which was 4.1%. In addition, 7.22% of adolescent used marijuana in 2013-2014, which corresponds to approximately 1.8 million adolescent users? Risky behavior in youth used marijuana in 2013 at a rate of 23.4%, more than three times the rate of the general population. In the past year, prevalence of DSM-IV marijuana use disorder was 1.5% in 2001 and 2002 and 2.9% in 2001 and 2003. In 2014, marijuana use disorder was 1.6%, which was consistent to the percentages for most years after 2005 [29]. However, the actual prevalence of marijuana addiction is likely much higher as over 50% of cannabis users appear to have impaired control over their use and symptoms of intoxication and withdrawal. Irritability, anxiety, craving and disruptive sleep have been reported in 61-96% of cannabis users during intoxication and abstinence [6].

Public opinion

In the US, public policy is based on public opinion, and is the basis for use and laws regarding marijuana. Contributing to the rise in prevalence in marijuana use and addiction in the US is the increasing view drug abuse or drug problems as less important in recent years than in prior years [30]. According to Gallop polls between the early 1970s and the late 1970s, drug abuse was the most common and most important problem named in the public. Between 1979 and 1984 drug abuse did not appear at all in the gallop polls among the most often mentioned problems, indicating a relatively consistent low level of concern about the issue [29,30].

Not surprisingly, the support for the legalization of marijuana has conversely increased with decreasing public concern [31]. In 1969, only 12% of the US population supported the legalization of according to a Gallop poll [32]. By 2000, the support for marijuana legalization reached 30%. From 2000-2015, public support for the legalization of marijuana nearly doubled. In 2015, 58% of the population were in favor of marijuana legalization. This trend in support of marijuana legalization is likely to continue to increase. In 2015, 71% of young adults were in support of marijuana legalization. The decrease in concern about marijuana use and the increase in support of marijuana legalization will undoubtedly result in increased marijuana addiction [32].

Compulsive use

Adverse consequences

The compulsive use of marijuana is continued use despite adverse consequences. These adverse consequences are a direct and indirect result of the marijuana addictive use. DSM-5 identifies and classifies the various states that collectively constitute adverse consequences from addictive use pertaining social, interpersonal, occupational, educational, legal and medical adverse consequences [33].

Cannabis is most commonly smoked via a variety of methods including pipes, water pipes, cigarettes (joints or reefers) or, more recently, in the paper of hallowed out cigars (blunts) [3,4]. Cannabis is also sometimes ingested orally, typically by mixing into food. More recently, devices have been developed in which cannabis is vaporized. Individuals with cannabis use disorder may use cannabis throughout the day over a period of months or years and, thus, may spend many hours a day under the influence. Cannabis use affects work with repeated absences or increased risk working around dangerous situations. Arguments with spouses and other interpersonal relationship difficulties along with legal, medical, and mental health problems arise with cannabis use [6].

Importantly, whether cannabis is being used for "legitimate purposes", individuals who use cannabis are subject to and at high risk for developing a cannabis use disorder. Whether it is legal or illegal, use does not change the pharmacological properties of THC nor the addiction potential. Interestingly, the legal use of medical marijuana contains high TCH concentration and potency.

Marijuana and accidental trauma

Compulsive use is demonstrated in the adverse consequences from accident and trauma due to marijuana use. The increasingly relaxed stance on marijuana predictably inflates the volume of accidents and subsequent trauma that result from marijuana. Montana Narcotics Chief Mark Long stated, "DUI arrests involving marijuana have skyrocketed, as have traffic fatalities where marijuana was found in the system of one of the drivers". A study conducted by SADD found that driving under the influence of marijuana is currently a greater risk that drunk driving. In Washington State, cases where the driver tested positive for THC increased by 33 percent in the first six months of 2013.This is compared to a 7.9 percent decrease from 2011 to 2012. Additionally, Nevada's Traffic Bureau illustrates that from 2002 to 2012, 45 percent of drivers who were impaired by drugs had marijuana in their system [34].

Relapse and recurrence

Relapse or an inability to abstain is easily seen in the regular daily use of marijuana. Marijuana can also be used more intermittently with adverse consequences, which would indicate a pattern of relapse as well. Of importance, addiction is the inability to abstain from marijuana, particularly in social, occupational, and legal situations that increases the risk of dangerous outcomes and disability.

Marijuana and disability

As with published reports on social security disability associated with prescription opioid medications, it is likely that marijuana use leads to disability that is caused by the marijuana [35]. As with opioid addiction and disability, disability due to marijuana renders the user unable to perform social, occupational and avoid legal consequences at government expense. Prescribed opioid use in relation to disability, which has been more extensively studied, can serve as a comparison to marijuana addiction affecting disability claims. In a study of disabled Medicare beneficiaries under age 65 years, there was a significant overall rise in prescription opioid consumption. This increase was not driven by overall use in more people using opioids but rather the proportion of those using opioids chronically and addictively, at least 6 and on average 13 prescriptions per year. The authors state that the effectiveness of such a sustained and high dose is supported by scant evidence in this study.

Specifically, for marijuana and disability, a study looked at the level of drug abuse among individuals enrolled in the Supplemental Security Income and Social Security Disability programs. Among these individuals, 23% had a lifetime dependency on marijuana, consistent with the various populations of federal aid recipients. This finding illustrates that almost one quarter of individuals receiving federal aid were using marijuana. This percentage will undeniably increase as the marijuana is more easily accessible through legal means as with opioids and addiction leads to disability [36].

The study also illustrated that the individuals that had the most difficulty obtaining work were the group with the most psychiatrically impairments. Marijuana use increases psychiatric symptoms and is associated with psychiatric disorders at alarmingly high rates. Therefore, marijuana use and addiction lead to increased unemployment and disability resulting in extremely high costs not only to the individual but also to the public. As in the case of prescribed opiate use, marijuana is not a permanent and medically necessary disability under Social Security Disability and/or other forms of disability. Marijuana associated disability is reversible and improves or resolves with cessation of marijuana use.

Marijuana and Other Drug Use and Addictions

For some time, marijuana has been considered a gateway drug to other drugs, such as alcohol or heroin, or nicotine. There is a generalized vulnerability to addicting drugs including alcohol, and they are substituted and used interchangeably. The use of one addicting drug increases the probability of using another addicting drug. Marijuana use is highly correlated with alcohol, opioids including heroin and prescription opioids, and cocaine use disorders [37]. All these drugs act through the mesolimbic reinforcement area in the brain and have a common pathway for addictive use. Predictably, use of one addicting drug, such as marijuana leads to the use of additional addicting drugs as in a generalized vulnerability to drug addiction [38].

One such study illustrated the biological effects of THC on the brain. Adolescent rats, treated with THC, illustrated an upward shift of self-administered heroin throughout the study. Conversely, adolescent rats without the THC maintained the same pattern of heroin administration. This supported the hypothesis that adolescence marijuana use has an impact on hedonic processing that result in increased opiate intake, which could be the consequence of altering neurological pathways [39].

Additionally, another study examined the effects of marijuana use among twins [40]. The study gathered information from sets of twin in which one twin used marijuana before age 17, while the other twin abstained from marijuana use before they were 17 years old. The study illustrated that the individuals that used marijuana prior to 17 years of age were 2.1 to 5.2 times higher than their co-twin to have other drug use, alcohol dependence and drug abuse/dependence. This study clearly illustrates that early marijuana use increased a person's likelihood of using or abusing other drugs [40].

For marijuana to be a gateway drug, the use must be prior to the use of other drugs. In 2013, 70.3% of adult users of illicit drugs stated marijuana was their first illicit drug used [41]. This fact alone is a strong indicator that marijuana is used as a gateway for use of other illicit drugs. Consistent with this statistic, studies of adolescent illicit drug use indicate that marijuana is used more frequently by 12-17 year olds than other illicit drugs [42]. In 2014, marijuana use by adolescents was at 7.4%, followed by non-medical use of psychotherapeutics at 2.6%. Marijuana use, at 7.4%, was higher than the percentage of other illicit drugs use by adolescents combined, which only totalled 4.0% [43].

Statistics also illustrate that marijuana use is also a gateway for tobacco use. As cited previously, adolescent marijuana use was 7.4% and adult marijuana use was 7.5%. Comparatively, cigarette use among adolescents was 5.6% and adult cigarette use was 21.3% in 2013. This implies that while adolescents use marijuana in their youth, they add cigarettes as they grow older which implicates marijuana as a gateway drug [12].

Conclusion

DSM-5 Substance-Related Disorders and Addictive Disorders provide a valid and reliable diagnostic framework for Cannabis Addiction (Marijuana) based on extensive scientific documentation for Cannabis Use Disorders. Cannabis Addiction is a highly prevalent public health issue and common clinical problem that can be identified and diagnosed by a discernable pattern of preoccupation with use, compulsive use with adverse consequences, and a pattern of use over time.

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