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The Neurobiology of Today's Marijuana¹

Jody Belsher, BA

Neurobiology is the study of the brain and nervous system, which are the cells and tissue that generate sensation, perception, movement, learning, emotion, and many of the functions that make us human.

ABSTRACT:

To understand the implications of Cannabis as a prevalent factor in co-occurring disorders among youth.

1. OVERVIEW: THE PROBLEM
2. UNDERSTANDING TODAY'S MARIJUANA
 - a) Composition / Potency
 - b) Normalization
 - c) Vulnerability
 - d) Lack of education
3. THE EFFECTS
 - a) Brain issues

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- b) Addiction/tolerance
 - c) Mental illness
 - d) Physical effects
4. MANAGING THE NEW NORMAL
- a) Recovery programs
 - b) Therapies/Treatment
 - c) Spirituality/Meditation
 - d) Nutrition
 - e) Exercise
 - f) Education
 - g) Practitioners planning for the future
5. CONCLUSION

1. OVERVIEW: THE PROBLEM

Young people are presenting with co-occurring disorders where marijuana is a prevalent factor. The use of marijuana and the presence of mental illness is increasing in the vulnerable adolescent through age 30 population. Marijuana, specifically THC, presents a risk for mental illness for youth. The increased prevalence of marijuana use coupled with mental illness is rapidly becoming a phenomenon with the potential for an epidemic. Whether marijuana is triggering the onset of mental illness, or being used to self-medicate—which exacerbates mental illness—is difficult to ascertain. What is known is that there is a connection between the two disorders (1-NIDA). To understand how and why cannabis has become a catalyst to mental illness, it is necessary to examine the contributing factors, as well as to recognize the direct *effects* of today's marijuana on mental health. Further, it is imperative practitioners be prepared to address this increasing disorder.

2. UNDERSTANDING TODAY'S MARIJUANA

There are four key aspects that have significantly contributed to the increase in co-occurring disorders with marijuana as a factor:

- a) Composition & Potency
- b) Normalization
- c) Vulnerability
- d) Lack of Education

a) COMPOSITION AND POTENCY

Cannabis is also known as marijuana, weed, pot, grass, dope, Mary Jane, and a variety of other names. The Cannabis plant consists of more than 400 chemicals. The two main chemicals are THC (delta9-Tetrahydrocannabinol) and CBD (Cannabidiol). THC is the psycho-active chemical that is responsible for the high feeling, while CBD is the non-psycho-active chemical that serves to counteract the psycho-active THC. Levels in the 60s and 70s, a popular period for casual marijuana use, were about 1-3% THC. In today's marijuana, growers have bred the seed to yield levels averaging 15-25% THC in a marijuana cigarette (2-MAYO CLINIC). In some forms--such as butane extracted dabs or honey oil, the THC levels exceed 95% THC (3- MEDICAL DAILY).

As the levels of psycho-active THC have increased, the levels of the protective CBD chemical has decreased.

The plant, which is balanced in nature, is unable to produce both chemicals at high levels

(4-UKCIA). Therefore, as THC levels go up, CBD protective levels naturally go down. It is this potent THC level that is at the core of today's issues: triggering and/or exacerbating mental illness, prompting increased tendency to addiction and causing negative physical and emotional outcomes.

Medical v. Recreational

The marijuana industry is aggressively funding and campaigning to the public on the merits of marijuana. The confluence of what constitutes medical marijuana and what is recreational has confused our youth, creating a setting whereby they believe the drug they are using is a medicine--regardless of its composition, the potent levels of THC, or the *effects* on the developing brain (5-DEA). Promoters have purposefully blurred the lines between what youth are using recreationally and what they term medicinal products. There is no clear cut *difference* between these two products and no clear delineation when marijuana is discussed. In fact, the chasm of misunderstanding continues to misguide our youth into believing that they are using a medicine when using any marijuana products. This misunderstanding has fueled youth to continue using despite potential risks or negative consequences, and provides them with a forum for promoting their use of marijuana. Additionally, young people are influenced by numerous unreliable and often misleading internet claims, peer pressure and targeted promotions geared to attract them (6-ATAKAN). According to neuroscientist Dr. Christine Miller,

even some studies published in scientific journals are not large enough or well-controlled enough to establish a positive or negative finding, which skews the conclusions of their studies. Frequently the retractions to the false claims can be found buried deep in a website or newspaper.

CBDs as a Medicine

On the other hand, there is a lot of promise for the medicinal use of CBDs--the non-psycho-active component. Even so, while non-smoke medicinal use of CBDs is gaining ground, there is still much that is unknown: long range robust studies, long term outcomes, interactions, delivery methods, dosing, etc. However, initial studies are indicating a positive trajectory for the use of CBDs, particularly for anti-psychotic behavior. It is also useful that CBDs are not mind-altering and therefore can provide medicinal properties without the psycho-active risks (7-lbid).

Risks

What is known at this time is that the use of the psychoactive compound THC--whether medicinally or recreationally, during the brain's developmental years, presents a risk for negative outcomes. As long as the brain is developing, the risk for mental illness is present. When considering usage for someone in the under 30 age group, it is imperative to consider potential risks versus benefits (8-NIDA).

But it's Natural

Cannabis is considered by many to be all-natural. In addition to the more than 400 naturally occurring chemicals--with potential chemical interactions--the cannabis plant often tests positive for toxic pesticides, molds and bacteria (9-BUS. INSIDER). These toxic findings have also been discovered in the organic varieties of the plant. A lack of standards and lack of regulations exists even in legalized states (note: Federal law still prohibits its use and sale), and has fostered a market that has unreliable and potentially unsafe products (10-LA WEEKLY). The growers are faced with protecting their profitable crops, which can yield large financial gains. This can result in the need to use highly toxic chemicals to kill such bugs as aphids that attack the plants (11-TRUTH).

While youth profess that marijuana is safe because it is a natural plant, it is prudent to point out some of the other natural plants, such as poison ivy, arsenic and other deadly species. Further, we derive the very important medicinal morphine from the Opium plant. This does not suggest that since we get this important drug from this plant that we should legalize Opium so everyone can have access to it. The same standard is not being applied to the Cannabis plant. Marijuana as a medicine needs to be correctly processed, regulated, administered and dosed in a professional, reliable and safe way. Today's marijuana is provided by marijuana dispensaries, which are storefronts that distribute "medicine" without the proper safety protocol of other drugs. Often staff at the dispensaries are making medical recommendations without appropriate knowledge.

Marijuana Products

Marijuana today is being used in a variety of methods. In addition to smoking joints that may be combined with tobacco or other drugs such as cocaine or LSD, marijuana users are also smoking blunts—hollowed out cigars, in addition to an even more potent new form of cannabis product called dabs. Dabs—also known as butane hash oil (BHO), honey oil, budder, shatter or wax—is a highly concentrated extract of THC. It is smoked through a water pipe/vaporizer or charcoal puck. Some people will place a drop or two on the end of a cigarette before smoking it. Students have been known to “dab” the oil on their tongues while in class. Others will create candies and edible products or balms from the resin. It induces an instantaneous, powerful high that some users have described as being like the first time they smoked marijuana. Most people who use BHO are under the age of 25, which is the age group most vulnerable during brain development.

Dangers of Butane

Producing dabs is an extremely dangerous process involving butane gas, which extracts the THC. The mixture is heated up to evaporate the butane so only the thick concentrate remains. This can lead to explosions small enough to cause severe burns and large enough to light homes on fire. It's easy for users to consume more than they desire (12-FUSION).

All plants are coated in a cuticle wax and most BHO contents are comprised of 15 to 20 percent cuticle plant wax. This wax is inhaled into the lungs when BHO is vaporized. There are theories that this practice can lead to nodules on the lungs that can decrease breathing capacity and cause granulomas (13-DUAL)

Difficulty Dosing

Dosing has proven to be a critical issue as THC stores in the body's fatty tissue cells and reacts differently on each person. This has created a profound issue when it comes to edibles and drugged driving standards. Some states have established a 5 nanogram per milliliter limit of THC in the blood. However, 5 nanograms per milliliter to one person can be very different to another. Using marijuana can impair judgment, motor coordination, ability to concentrate and slow reaction time, and therefore can impair driving skills (14-VERY WELL).

b) NORMALIZATION

As the world continues to embrace marijuana as an accepted recreational and medicinal drug and more and more American states are voting to legalize it, we are seeing an unprecedented rise in usage by youth. When the perception of harm goes down, usage goes up (15-SAMHSA). With normalization has come more widespread use, which explains in part why we are seeing a rise in mental illness coupled with marijuana use. Society is helping promote the message that marijuana is harmless. We see its casual use in films and on television depicting usage as normal for everyone (16-AACAP). We now are seeing families using together. Accepting the negative implications of marijuana is not yet embraced by our culture.

Big Money Behind Today's Industry

The marijuana industry, now backed by major tobacco and investment companies, is posturing to profit from widespread use. As was established by the tobacco industry of the past, the objective is to addict youth—the target population—in order to create a viable business model. While we have done a successful job of educating on the negative *effects* of cigarette smoke, we are now welcoming, with open arms, another smoke product that is poised on the same trajectory as the tobacco industry. (17-FORTUNE)

Science v. Society

Researchers predict that it may take decades to realize the full impact of marijuana on our society (18-HARVARDOSC). They claim that the science is currently available, but our culture has not caught up to the science. In the meantime, we will continue to see an increase in mental illnesses triggered by this powerful THC laden drug, as well as other physical, emotional, financial and societal issues (19-CANADIAN).

c) VULNERABILITY

Those who have a genetic predisposition to mental illness are particularly vulnerable to experiencing a psychotic event or other issue from using marijuana (20-PUBMED). In fact, even the general population is vulnerable to negative outcomes from these potent levels of THC (21-MISCH). There have been a number of gene studies conducted that are indicating who is at risk for psychotic events related to marijuana use. Although the studies show a connection, the evidence so far is inconclusive.

The Gene Pool

Genes that have shown indicators for psychotic predisposition to marijuana include the AKT1 and the COMT genes (22-HARVARD). Adolescents are at higher risk for psychosis. “Individuals with polymorphisms of COMT and AKT1 genes may be at increased risk for psychotic disorders in association with cannabinoids, as are individuals with a family history of psychotic disorders or a history of childhood trauma. The evidence indicates that cannabis may be a component cause in the emergence of psychosis” (23-FRONTIERS). The reality is that at this time, no one is going to go through the expense and complication of determining whether or not they are genetically safe from psychosis if they use marijuana.

d) LACK OF EDUCATION

There are a number of factors that have prevented society from educating on today's marijuana. The generation of the 60s and 70s doesn't realize or understand that the marijuana that they were using then is not the same product that is being used today. This lack of understanding promotes a pervasive philosophy that it is “just pot” and what is all the fuss about? Many of those in the education system are of that same generation, or from a later generation that has yet to be informed on the potential dangers of today's THC potent marijuana. They themselves

may have used or currently use marijuana without harm. However, if they are older than 30, they most likely were not at risk for the major harms that those under 30 are exposed to today. Furthermore, there are no labels on marijuana products that indicate the risk factor for youth. Alcohol bottles are labeled with potential side effects and prescription drugs have potential negative effects listed. Unfortunately, these warnings do not exist today for marijuana.

Education in Schools

Schools are reluctant to teach about marijuana. A number of district superintendents have stated that they do not have a marijuana problem and need to focus their attention on such drugs as heroin or prescription pills. Some schools risk losing funding if they admit there is a drug problem on campus. Although marijuana may not have the same short term risk of immediate death as other drugs, today's potency sets it up as a gateway drug, and for some, the short term and long term *effects* are equally as devastating. We do not have long term studies on this new potency to safely say that it does not cause death. Cases of one time use triggering full-blown psychotic events are beginning to surface. Students think of marijuana as harmless. They don't start with heroin. It is common for them to begin experimenting with alcohol or marijuana. With the increased normalization and legalization of marijuana, more students are now turning to marijuana as their first drug, as marijuana has become easier for them to access (24-SANDAG).

The New Face

The marijuana lobby was once a small group of marijuana enthusiasts. Today, polished business investors are at the forefront of this new industry. It is bolstered by multi-millionaires who are not so much using the products, as they are positioning themselves as recipients of a lucrative industry. Entrepreneurs such as George Soros and Sean Parker have spent millions on campaigns promoting the benefits of marijuana (25-SAC. BEE). Unfortunately, along with their widespread promotions to use marijuana, they have failed to provide any information, warnings or education to the vulnerable youth population on the drug's side *effects*.

3. THE EFFECTS

- a) The Brain
- b) Addiction / tolerance
- c) Mental illness
- d) Physical effects

a) THE BRAIN

THC, acting through cannabinoid receptors, activates the brain's reward system. This includes regions that govern the response to healthy pleasurable behaviors like sex and eating. Like

most other drugs of abuse, THC stimulates neurons in the reward system to release the signaling chemical dopamine at levels higher than typically observed in response to natural stimuli. This flood of dopamine contributes to the pleasurable “high” that recreational marijuana users seek (26-ASAM). Studies show there is a 20% loss of dopamine in chronic marijuana users. According to researchers at INSERM France, the beginning stages of Parkinson’s Disease indicates a 25% loss of dopamine, which puts them both on the same biological level.

Pruning

The human brain develops primarily during the adolescent and teen years. During this developmental stage the pruning process occurs. Pruning is when the brain essentially throws away unused and unnecessary pathways in order to allow for more *efficiency*. This is why it is a good idea to learn a language when we are young—when our brains have a pathway established for learning. A recent study on pruning suggests that schizophrenia is triggered by an “over pruning” of the brain (27-SCIENCE DAILY). Since research has shown that high potency THC disrupts the pruning process, this may explain why THC is so detrimental during these developmental years. It is this disruption that may be the catalyst to mental illness brought on by marijuana use. In addition, it is this pruning process that may explain the finding that most of the major psychiatric disorders—thought, mood, and anxiety—have their major onset during this vulnerable period. Pruning may have an effect on genetically or experientially vulnerable circuits. The neuropathways that are actively utilized may remain, however, those underutilized may be removed. This is why it is often referred to as the “use it or lose it” period. In our youth we go through the process of developing our potential as our brains are wired according to our needs (28-PSYCHOLOGY).

Our Natural Neurochemical Anandamide

THC’s chemical structure is similar to the naturally occurring brain chemical anandamide. This similarity allows the drug to be recognized by the body and to alter normal brain communication. According to the National Institute on Drug Abuse (NIDA), these endogenous cannabinoids function as neurotransmitters because they send chemical messages between nerve cells (neurons) throughout the nervous system. They *affect* brain areas that influence pleasure, memory, thinking, concentration, movement, coordination, and sensory and time perception.

Because of the similarity to our body’s own natural neurochemical anandamide, THC is able to attach to molecules called cannabinoid receptors on neurons in these brain areas and activate them, disrupting various mental and physical functions. The neural communication network that uses these cannabinoid neurotransmitters, known as the endocannabinoid system, plays a critical role in the nervous system’s normal functioning, so interfering with it can have profound effects (29-NIDA).

Impairment caused by THC is able to alter the functioning of the hippocampus and orbitofrontal cortex, brain areas that enable a person to form new memories and shift their attentional focus. As a result, using marijuana causes impaired thinking and interferes with a user’s ability to learn and to perform complicated tasks. THC also disrupts functioning of the cerebellum and basal

ganglia, brain areas that regulate balance, posture, coordination, and reaction time. This is the reason people who have used marijuana may not be able to drive a car safely and may be impaired at playing sports or performing other physical activities (30-Ibid). Harvard researcher Jodi Gilman's study on marijuana and the brain concluded that even once a week users were at risk for the same negative outcomes as more frequent users.

Loss of IQ

Long-term, regular use of marijuana—starting in adolescent or teen years—may impair brain development and lower IQ, meaning the brain may not reach its full potential (31-NIDA TEENS). An Australian study revealed a disturbing decline in IQ (up to 8 points if prolonged use started in adolescence). This loss of IQ may be related to studies showing poor school performance and an increased likelihood of dropping out (32-NIDA).

Other brain issues include impaired thinking, ability to learn and perform complex tasks, lower life satisfaction, potential development of opiate abuse, relationship problems, intimate partner violence and antisocial behavior including stealing money or lying. These problems contribute to financial difficulties, increased welfare dependence and greater chances of being unemployed or not securing good jobs (33-HUDSON).

b) ADDICTION

Tolerance

Since marijuana has become more potent, the risk for addiction has also increased. Tolerance levels have become greatly affected by these stronger levels of THC. With increased tolerance, the user can quickly develop a dependence on the drug. Marijuana has recently been classified as a drug of addiction, due to its physical and psychological effects, as well as having a withdrawal syndrome (34-MEDSCAPE). Abruptly stopping or no longer using marijuana after a prolonged phase of marijuana use can lead to such withdrawal symptoms as: irritability, insomnia, poor appetite, anxiety, depression, agitation, cravings and mood swings. As the marijuana withdrawal symptoms progress, they will typically peak around the third or fourth consecutive day of abstinence. Within about a week or two, all symptoms of marijuana addiction will usually subside and the user can return to normal. However, there are negative effects that can continue on for a prolonged period of time. Most of these symptoms are mental or psychological in scope and will require some type of treatment and or counseling in order to overcome. (35-MENTAL HEALTH).

Rate of Addiction

Research shows that approximately 9 percent, or about 1 in 11, of those who use marijuana will become addicted. This rate increases to 17 percent, or about 1 in 6, if you begin during your teens, and goes up to 25–50 percent among daily users (36-NIDA/NIH). Addiction presents a major challenge to co-occurring disorder recovery. It is imperative to address both disorders concurrently, however, sobriety is key to successful recovery.

Denial

One of the common traits of addicted marijuana users is to be in a state of denial. They see the societal acceptance, hear of the medicinal values and observe others who have used without consequence. This “perfect storm” of positive perception and lack of insight, only fuels the addict to continue use, in spite of negative consequences—precisely the definition of addiction.

Cannabis Use Disorder

According to “Cannabis-Related Disorders Clinical Presentation,” Cannabis use disorder is defined as a problematic pattern of cannabis use leading to clinically significant impairment or distress, as manifested by at least 2 of the following, occurring within a 12-month period: Cannabis is often taken in larger amounts or over a longer period than was intended. There is a persistent desire or unsuccessful *effort* to cut down or control cannabis use. A great deal of time is spent in activities necessary to obtain cannabis, use cannabis, or recover from its *effects*. A craving, or strong desire or urge to use cannabis. Recurrent cannabis use resulting in a failure to fulfill major role obligations at work, school, or home. Continued cannabis use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the *effects* of cannabis. Important social, occupational, or recreational activities are given up or reduced because of cannabis use. Recurrent cannabis use occurs in situations in which it is physically hazardous. Cannabis use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by cannabis.

Tolerance, as defined by either a (1) need for markedly increased cannabis to achieve intoxication or desired effect or (2) markedly diminished effect with continued use of the same amount of the substance. Withdrawal, as manifested by either (1) the characteristic withdrawal syndrome for cannabis or (2) cannabis is taken to relieve or avoid withdrawal symptoms (37-CLINICAL).

c) MENTAL ILLNESS

It has long been established that marijuana use—even in the less potent THC years—has been prone to causing such negative reactions as paranoia, anxiety and depression. The newer, more potent levels of THC are not only causing these same reactions, however, additionally, we are now seeing an increase in more severe mental illnesses, such as schizophrenia, bi-polar, and psychosis (38-HARVARD).

Co-occurring Disorders

Co-occurring disorders (COD) previously called Dual Diagnosis, is the condition of suffering from a mental illness along with a co-morbid substance abuse. Diagnosing a primary psychiatric illness in substance abusers is challenging since drug abuse itself often induces psychiatric symptoms. It is difficult to untangle which is driving which—the substance or the mental illness. (39-DUAL DIAGNOSIS). What is most important is that patients who are co-morbid are already

dealing with higher symptom levels compared to patients with only one disorder, and the impairment of their natural ability to cope with stress causes an even greater risk for relapse (40-NCBI.NIH).

Co-occurring mental health conditions and substance use disorders *affect* nearly 8.9 million Americans each year. Of those only 7.4% receive appropriate treatment, with the vast majority bounced among treatment systems with *different* and opposing treatment structures. Nationally, research continues to reveal that people with co-occurring disorders need a specialized form of treatment, referred to as integrated services or dual diagnosis treatment. Mental health treatment and addiction treatment have historically, and continue to be, separated systems of care. While many research studies have been performed on mental health and addictions separately, it has only been within recent years that studies have emerged on people who struggle with both conditions in tandem. This emerging research identifies that traditional separated systems of care not only alienate the consumer from treatment, but they also result in much poorer outcomes than those experienced by people with single disorders. More surprising, we are now learning from these studies that programs predominantly designed to treat a specific disorder are actually only capable of treating the minority of those in need. In fact, up to 65.5% of people with a substance dependence disorder had at least one mental disorder and 51% of people with a mental disorder had at least one substance abuse disorder (41-Ibid).

Marijuana Addiction and Schizophrenia

Marijuana abuse is often seen in those who are diagnosed with schizophrenia. It is not unusual for people who have schizophrenia to develop addictions. A study in the American Journal of Psychiatry posits that about half of all people with schizophrenia also have a substance abuse disorder. There is a particularly striking association between marijuana abuse and schizophrenia. Many of the same negative symptoms that people with active schizophrenia experience are also experienced when using marijuana (42-Ibid). Schizophrenia and cannabis co-morbidity was deemed an epidemic in 2009 (43-WILSON, CADET).

THC Trigger for Mental Illness

Studies conclude that THC is a known trigger for mental illness. It is unclear, however, whether or not the mental illness was dormant and triggered, was predisposed and would have occurred regardless, or if it was entirely caused by the usage of THC products. The association of use and outcome is clear, however (44-PSYCHIATRY). Many chronic marijuana users suffer from anhedonia: the inability to experience pleasure when not intoxicated, as well as anxiety disorder, paranoia and a-motivational syndrome (45-DISORDERS).

Psychosis

The potential for psychosis in association with marijuana use is well-documented (46-CLINICAL). In addition to schizophrenia, psychotic disorders include bi-polar, major depression disorder and may manifest as a permanent psychotic disorder or transient acute psychosis—a

psychosis that is drug induced and dissipates upon cessation of use. Psychosis refers to a detachment from reality and may include hallucinations and delusional thinking. When this occurs, it is called a psychotic episode. Psychosis usually first appears in a person's late teens or early twenties. Approximately three out of every 100 people will experience a psychotic episode in their lifetimes. It occurs in men and women and across all cultures and socioeconomic groups.

Psychosis can be treatable. Many people recover from a first episode of psychosis and never experience another psychotic episode (47-CENTRE). However, there is no guarantee that once triggered, the psychosis does not persist.

Delaying Onset

The risk is that THC may trigger the onset of schizophrenia, possibly years earlier than it would have occurred or the illness may be exacerbated by the use of marijuana. Schizophrenia may or may not be transient and may continue despite cessation of marijuana use. What is important to note is that marijuana may trigger a mental illness that may not have surfaced for years to come, if ever. This is a significant point, as the earlier the onset of a mental illness, the more *difficult* it is to treat—both the illness and the marijuana disorder. Therefore, regardless of predisposition, it is always best to delay onset of mental illness (48-APA). A study in Australia recently showed that those who used cannabis could develop the illness about 2.7 years earlier than those who did not (49-ROYAL).

Depression

Marijuana users are 4 times more likely to develop depression. One study looked at 1,920 people, and followed them for 16 years. It discovered that people who smoked marijuana were 4 times more likely to develop depression. Another study looked at 1601 students aged 14-15 and followed them for seven years. Approximately 60% of the students had used marijuana by the age of 20, and 7% had become daily users. Marijuana almost triples the chance of developing psychotic symptoms. A 3-year study followed 4,045 psychosis-free people. It came to the conclusion that marijuana smokers are three times more likely to develop psychotic symptoms (including manic-depression) than non-smokers. Other symptoms include: severe anxiety, paranoia—fear that one is being watched or followed, strange behavior, seeing, hearing or smelling things that aren't there, not being able to tell imagination from reality (psychosis), panic, hallucinations and loss of sense of personal identity (50-ADDICTIONS).

Not Everyone has a Problem

Not everyone who uses cannabis, even at a young age, develops a psychotic illness. The available research shows that those who have a family history of a psychotic illness or possibly have certain types of genes, may increase the risk of developing a psychotic illness following the regular use of today's potent cannabis. The variables are not only genetic and environmental, but also include age of commencing use of marijuana products, duration and

amount of use. At this time, no one can be certain if they are at risk, which indicates that all youth are vulnerable and should be educated on these potential dangers (51-GUARDIAN).

d) PHYSICAL EFFECTS

A number of physical effects from the use of marijuana have been found to occur and have a profound impact on treatment for co-occurring disorders. These physical effects complicate and compromise recovery. Studies are showing such negative physical effects from THC as heart attacks and strokes, even in teenagers. Heart rates of subjects increased an average of 29 beats per minute when smoking marijuana (52-CANADA).

A New Marijuana-induced Illness

Cannibinoid Hyperemesis Syndrome (CHS) is a new diagnosis that is being seen frequently in emergency rooms across America. CHS is marked by uncontrolled vomiting with severe abdominal cramps that are only soothed by warm baths or showers. The only cure is to cease using marijuana. Many people believe that marijuana can help them with nausea and therefore continue using it, when in fact the marijuana may be what is causing the vomiting (53-NCBI).

Bronchial Problems

Long-term lung adverse affects are unconfirmed, however, health professionals warn that there are actually more carcinogens in a marijuana cigarette than a regular tobacco cigarette. Regular cannabis smokers may show many of the same respiratory symptoms as tobacco smokers. These include daily cough and phlegm, chronic bronchitis, and more frequent chest colds. Continued use can lead to abnormal functioning of the lung tissue, which may be injured or destroyed by the cannabis smoke (54-CSAM).

Additional Problems

Further, there are additional problems with lowered reaction time and coordination, which can lead to impaired driving and compromised motor function. Also, males can experience sexual problems and females are up to seven times more likely to contract sexually transmitted infections than non-users (55-MIND DISORDERS).

5) MANAGING THE NEW NORMAL

Identifying the Problem

According to Mayo Clinic, drug addiction symptoms include: Cravings for the drug, tolerance for the drug, which leads to higher doses of drugs, hoarding the drug, spending money that should go to household expenses on drugs, cutting back on work, hobbies, or social activities in order to use, taking risks while under the influence, failed attempts to stop use and a need to use the drug regularly, either daily or several times per day. Other indicators of the disorder are lying, stealing, unaccounted for time, problems with family and other relationships, raging, loss of

sleep, problems at work or school, disinterest in things once enjoyable, irrational behavior, illogical thinking, hallucinations, delusions, detachment from reality, problems sleeping, loss of appetite, depression and general apathy toward life.

Often times the user is in denial and may or may not be ready to admit there is a problem. Sometimes the user needs to hit a “bottom” in order to accept there is an issue. People with marijuana addictions aren’t weak, bad, or wrong. They have a medical condition that responds to treatment, and they need help in order to recover. Approaching them in a calm and caring manner is advisable. This is easier to do when families are educated and recognize this as an illness.

Between legalization and normalization, the intervention process is complicated and achieving sobriety is a challenge. It is difficult to get a patient to stop using when 1) it is actively being advertised; 2) it is easily available; 3) it is legal; 4) it is perceived as harmless; 5) others use without issues. Using treatment modalities that address these issues in addition to the addiction and mental illness component is critical.

Treatment for Co-occurring Disorders

a) Recovery programs

Programs have historically failed to take marijuana addiction seriously. While treatment for co-occurring marijuana use disorder and mental illness is just now gaining attention, there is much to be done to address this population. Stigma against marijuana use disorder patients has been a detriment to integrating patients into sober programs. Adding the component of mental illness creates a new challenge to treatment. Marijuana is often viewed as a non-addictive substance and there is limited “buy in” from the treatment community as well as from society at large. Validating the marijuana addiction, recognizing the symptoms and treating both illnesses concurrently is essential to recovery.

b) Therapies/Treatment

Current treatment options include the following:

Cognitive-Behavioral Therapy

A form of psychotherapy that teaches people strategies to identify and correct problematic behaviors in order to enhance self-control, stop drug use, and address a range of other problems that often co-occur with them.

Contingency Management

A therapeutic management approach based on frequent monitoring of the target behavior and the provision (or removal) of tangible, positive rewards when the target behavior occurs (or does not).

Motivational Enhancement Therapy

A systematic form of intervention designed to produce rapid, internally motivated change; the therapy does not attempt to treat the person, but rather mobilize their own internal resources for change and engagement in treatment.

Medications

Research is actively pursuing medicinal treatment for marijuana addiction, however, as of today there are not many options. Because sleep problems feature prominently in marijuana withdrawal, some studies are examining the *effectiveness* of medications that aid in sleep.

Medications that have shown promise in early studies or small clinical trials include the sleep aid zolpidem (Ambien®), an anti-anxiety/anti-stress medication called buspirone (BuSpar®), and an anti-epileptic drug called gabapentin (Horizant®, Neurontin®) that may improve sleep and, possibly, executive function. Other agents being studied include the nutritional supplement N-acetylcysteine and chemicals called FAAH inhibitors, which may reduce withdrawal by inhibiting the breakdown of the body's own cannabinoids. Future directions include the study of substances called allosteric modulators that interact with cannabinoid receptors to inhibit THC's rewarding *effects* (56-NIH.NIDA).

Therapeutic Model

An analysis in the journal *Addiction Science and Clinical Practice* suggests that the goal of marijuana therapy is to provide people with the ability to avoid or cope with drug use triggers, so they won't relapse when put in *difficult* situations. Therapy can also provide problem-solving skills and lifestyle management, so people can learn how to build a satisfying life that doesn't need augmentation with drugs. As a relapse skill, therapists might also provide lessons on drug refusal, so people know just what to say and how to react when they're *offered* marijuana. Those therapy sessions might be augmented with support group work, so people with marijuana addictions can meet others in recovery. Marijuana is one of the most difficult drugs to give up. Not because it's more addictive than other drugs, but because addicts are more reluctant to let it go. They see it as their final vice (57-Ibid).

c) Spirituality / Meditation

The foundation of the AA 12-step program, as well as many other recovery programs, is to find a spiritual "higher power" in any form that can help to support the recovery process. There have been many studies on the *effectiveness* of meditation as a support in recovery as well.

d) Nutrition

A number of treatment centers have begun using nutraceuticals as a supplement to assist with recovery from addiction and mental health disorders. The Amen Clinic, known for their work on brain health, performs spec scans of the brain to indicate areas of the brain that have been

affected by the use of marijuana. To support the health of the brain, some of the possible nutraceuticals they suggest include: A multi-vitamin with vitamin D, Omega 3, Green Tea Extract, L-Tyrosine, GABA, Saffron, Ginkgo Biloba, SAME, Stress Relief and L-Tryptophan. Their holistic approach starts with supporting the health of the brain. Another potential modality used by the Amen Clinic includes the hyperbaric chamber to oxygenate and thus nourish the brain (58-TALBOT). Many of the supplements assist with the production of the body's neurochemical dopamine, which is notably decreased with addiction.

e) Exercise

One of the most under-utilized therapies for treatment of co-occurring disorders is exercise (59-JDAILY). Walking or movement of any kind is encouraged over the tendency of sedentary lifestyles typical of someone struggling with mental health and addiction issues. The endorphins that exercise produce can help alleviate some of the depression and anxiety that is experienced while going through and staying in recovery (60-ADDICTION). Exercise also has been known to increase dopamine levels, often referred to as a "runner's high" or "endorphin rush" (61-UHN).

f) Education

The average age of onset for substance use has significantly lowered in the past decade. In order to intervene, substance prevention education must be implemented at approximately 8 years old.

POSAFY (Prevention of substance abuse for youth) is a new non-profit organization that is targeting 11-14 year olds. Along with prevention, at-risk youth must be identified and addressed. This population is particularly vulnerable to co-occurring disorders in teen to early adulthood.

The opportunity to reach large numbers of youth is now possible through social media and video presentations. POSAFY is working on creating materials that will attract this population and educate them on the dangers of substance use (62-POSAFY). While filming the Other Side of Cannabis Documentary, it was ascertained that youth who are educated on substance will make healthier choices as they encounter opportunities to use (63-OSCDoc).

g) Practitioners planning for the future

With the influx of new cases of co-occurring disorders involving marijuana and mental illness, practitioners are beginning to see the increase in their practices. Where many recovery centers and rehab facilities once considered marijuana as a harm reduction drug or non addictive substance, they are now recognizing a need for programs to address this new and increasing demand (64-PNAS).

CONCLUSION

Due to a variety of converging changes with respect to the strength of today's cannabis and society's view of marijuana, we are now seeing an increase in co-occurring disorders where marijuana and mental illness are presenting simultaneously. The reduced perception of harm, the increase in potency of the product and the normalization, legalization and lack of education that is taking place today, all contribute to the increase in mental illness coupled with marijuana use disorders. Negative psychological and physical effects are also a factor in finding a path to sobriety. The effects on the brain include loss of memory, cognition and IQ, in addition to the diminished physical health effects such as bronchial, heart and stroke issues. The need for treatment measures and facilities that understand this complex disorder is gaining significantly. Education is a key factor in prevention, sobriety and societal support. Practitioners are advised to prepare for treatment of this co-occurring disorder through continued education, validating the disorders, understanding modalities and identifying patients. With a continuation of decline in perception of harm, increased legalization and increased availability, the climate for co-occurring marijuana and mental disorders is ripe. Education of practitioners, educators, students, politicians, law enforcement and society at large, is key to prevention, which is of paramount importance and always preferable to treatment.

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This article was prepared by Jody Belsher, BA, candidate for the Master of Arts in Addictive Disorders Degree from Breining Institute. Ms. Belsher is the Producer / Director of the documentary “The Other Side of Cannabis: Negative Effects of Marijuana on our Youth,” awarded as the winner of the Best Feature Documentary of the Sunset Film Festival (Los Angeles) in 2015; earned her Bachelor of Arts in Social Work / Music, *cum laude*, from Western Michigan University; and completed the Academy for Addiction Professionals’ Certified Recovery Support Specialist (CRSS) program.