FEATURE ARTICLE

Chronic Health Effects of Cannabis Use in Childhood and Adolescence

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ABSTRACT

Cannabis is the most commonly used recreational drug in the United States and use among adolescents is prevalent. Its availability and potency have increased significantly in the past decade, as a growing number of US states have legalized its use for medicinal or recreational purposes. Meanwhile, adolescent perception of the risk of harm from cannabis use has declined over time. However, there are well-established risks associated with prolonged cannabis use in adolescence. Cannabis has a strong link to the development of psychosis and psychiatric diagnoses, negative neurodevelopmental and school performance outcomes, poorer sleep, and gastrointestinal effects. Research is also showing potential risks related to the cardiovascular, pulmonary, and endocrine systems. The purpose of this article is to describe the long-term health effects of adolescent cannabis use. **[*Pediatr Ann*. 2025;54(6):e217–e221.]**

Children and adolescents are increasingly exposed to cannabis, as adult use has been legalized in a rising number of US states. This presents a growing challenge to pediatricians who must work to combat the perceived benign nature of the drug and confront the reality of negative long-term health effects. At the time of this report, cannabis remains federally classified as a schedule 1 substance under the Controlled Substances Act. At the state level, 47 US states and the District of Columbia have legalized the use of cannabis for medical purposes, while 24 US states and the District of Columbia have legalized recreational (ie, adult, nonmedical) use.[1]

Multiple studies have reported an association between cannabis legalization and increased incidence of pediatric exposures, accidental ingestions, emergency department visits, and cases of acute toxicity.[2–5] Legalization has led to significantly easier access and more widespread public use, increasing its visibility to children and adolescents and normalizing its use.

Self-reported intentional cannabis use among adolescents age 12 to 17 years has remained high but stable in recent years. National surveys, such as Monitoring the Future and the Youth Risk Behavior Survey, report ongoing high levels of marijuana use by adolescents. According to the 2023 National Institute on Drug Abuse Monitoring the Future survey, 8.3% of eighth graders, 17.8% of 10th graders, and 29% of 12th graders reported cannabis use in the past year.[6] With nearly one-third of US high school graduates reporting use, understanding the long-term health implications of cannabis is critically important to pediatric health.

The potency of cannabis products has also increased significantly over time. Delta-9-tetrahydrocannabinol (THC) is the psychoactive component in the cannabis plant, which is typically used as the measure of potency.[7] According to seizure data obtained by the Drug Enforcement Administration, the THC content of cannabis in 2022 was 16% compared with only 4% in 1995.[8] During the same period, adolescent perception of the risks associated with cannabis use has declined.[9,10] Studies have demonstrated significant decreases in perceived risk of harmfulness of cannabis over time, but this perception of risk rises as health literacy rises.[9]

Additionally, interventions to increase knowledge about the health risks of cannabis among adolescents have demonstrated a protective effect on adolescent cannabis use, thus suggesting that dissemination of education related to health risks associated with cannabis may play a role in decreasing adolescent cannabis use.[9]

The purpose of this review is to provide an overview of the long-term health consequences of cannabis use to equip pediatric providers with the necessary knowledge to counsel on the risks associated with use. Doing so can have significant public health implications.

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ACUTE TOXICITY

Perceived risk of cannabis use among adolescents decreases with increased use,[9] thus adolescents who use cannabis are at risk for using with increasing frequency and potency over time. Therefore, it is important to understand and briefly review the risk of acute toxicity. Cannabis intoxication presents with a variety of symptoms attributed to the THC component of the compound.

The presentation varies based on the amount and form of cannabis consumed. Children most commonly present with neurologic symptoms, including somnolence, slurred speech, ataxia, and disorientation.[7] Gastrointestinal symptoms include nausea and vomiting. More worrisome, bradycardia, hypotension, seizure activity, and respiratory depression requiring intubation can also be presenting symptoms.[7,10] Other effects include tachycardia, hypertension, tremor, and nystagmus.[11] Finally, psychiatric effects ranging from anxiety and panic to acute psychosis involving hallucinations and paranoia have been reported.[12]

Treatment for acute toxicity related to cannabis use is largely supportive, including observation in a nonstimulating environment, treatment of anxiety and vomiting, and management of seizures. The majority of children are treated and released from the emergency department or admitted for observation to a general pediatric unit if needed.[11] Severe cases of toxicity requiring intervention to support cardiovascular and respiratory function in an intensive care unit setting have been reported.

EFFECTS OF CHRONIC PEDIATRIC CANNABIS USE

Neurodevelopmental Effects

Cannabinoid receptors are distributed throughout the brain, particularly in the hippocampus and the prefrontal cortex, and play a role in the dopamine neurotransmitter system via the endocannabinoid system.[13] This system is composed of physiologic neurotransmitters that bind to the cannabinoid receptors, which are important for neurodevelopmental programming.[14] The hippocampus plays a key role in memory and learning, while the prefrontal cortex is involved in attention regulation, working memory, risk processing, and executive function.

Adolescence is a critical neurodevelopmental period during which the endocannabinoid system reaches peak activity; therefore, alterations of the system by exogenous cannabinoid use can have a negative impact on the development of critical neural pathways in the brain. The endocannabinoid system is also an important modulator of developmental processes that involve the dopaminergic reward pathways. Alteration of this system has neurochemical changes that can lead to poor cognitive and emotional outcomes later in life, as well as increased vulnerability to drug addiction.[14]

A review of studies on the effect of cannabis use on cognition demonstrate a negative impact on memory, processing speed, executive function, and intelligence quotient with persistent cannabis use, and the effect is most pronounced when use begins earlier in adolescence.[13,15]

While there are no definitive data, research suggests that cannabis cessation does not fully restore neuropsychological function.[14,15] These changes in cognitive function are supported by magnetic resonance imaging data comparing neuroimaging studies of cannabis use that demonstrate alterations in cortical development, particularly in the prefrontal areas, in patients who regularly used cannabis during middle to late adolescence in a dose-dependent fashion.[16]

While there is some variability among individuals that suggests an underlying genetic predisposition, as well as environmental effect, the evidence of an association between adolescent cannabis use and decreased cognitive function is strong.[14]

Psychiatric Illness

There exists a large body of evidence linking cannabis use with the development of psychosis and schizophrenia. Frequent use, initiation of use earlier in adolescence, and higher potency of THC products are all risk factors for the development of psychosis.[17–19] Therefore, psychosis can both be an acute response to cannabis intoxication, as mentioned earlier, as well as a long-term effect of chronic use. This is theorized to be the result of the distribution of cannabinoid receptors in critical neurotransmitter pathways in the brain.[13]

Cannabis use in adolescence has also been shown to have an association with a moderately increased risk of anxiety, major depression, and suicidal ideation in young adulthood.[20,21] Considering the relatively large number of adolescents reporting cannabis use, even a moderately increased risk could have a large impact at a population level.

Sleep

While cannabis had previously been thought to be conducive to sleep, it is now increasingly associated with poorer sleep outcomes. Studies have found a significantly increased association between cannabis and insomnia, with the effect being higher among those who use more frequently.[22] Other sleep complaints are associated with cannabis use as well, including daytime sleepiness, poor sleep quality, insufficient sleep on school nights, shorter total sleep time, and later bedtimes.[22,23] Sleep is an important factor in adolescent development, cognitive abilities, and mental and physical health.[23] Poor sleep can lead to

a cascade of other problems in adolescence, including behavioral disturbances and poor school performance.

Cardiovascular Effects

Acutely, cannabinoids tend to have a biphasic effect on the autonomic nervous system, which is dose-dependent, with lower doses causing increased heart rate and a sympathetic tone and higher doses causing bradycardia, hypotension, and a parasympathetic response. However, it is unclear whether this causes long-term cardiovascular consequences.[24] Adult and animal studies have demonstrated an increased risk of thrombosis, myocardial infarction, arrhythmia, and cerebrovascular accident.[24] This is an area of ongoing research that requires further investigation; however, this suggests a negative effect on cardiovascular health with long-term use.

Pulmonary Effects

The majority of studies evaluating the impact of cannabis use on respiratory symptoms, pulmonary function, and pulmonary disease thus far have been conducted primarily in the adult population. There is some association noted between cannabis use and respiratory symptoms (eg, coughing, shortness of breath, wheezing, sputum production), with a higher rate of symptoms reported by those who use cannabis even when controlling for nicotine and other factors.[25] Early research suggests an association between cannabis use and pulmonary disease, such as asthma and chronic obstructive pulmonary disease; however, more research is needed to better understand this risk.[22]

The strongest association impacting the adolescent population at this point is the increased risk of e-cigarette- or vaping-use–associated lung injury (EVALI). EVALI is a subacute respiratory illness with a wide range of respiratory and systemic symptoms linked to e-cigarette or vaping use within 90 days of symptom onset. EVALI is a potentially fatal condition that may have a lasting impact on pulmonary health.[26] The pathophysiology of EVALI is unknown, and it is unclear whether it is THC or another component of the vaping solution that causes the lung injury. During a highly reported EVALI epidemic in the United States between 2019 and 2020, approximately 16% of EVALI cases occurred in adolescents.[27]

Cannabis vaping is common among adolescents. In the 2023 Monitoring the Future survey, 6.5% of eighth graders, 13% of 10th graders and 20% of 12th graders reported having vaped cannabis during the prior 12-month period.[6] When addressing illicit drug use with adolescents, obtaining a history related to vape use and providing the appropriate counseling is an important consideration.

Gastrointestinal Effects

Cannabinoid hyperemesis syndrome (CHS) is the most common negative effect of cannabis on the gastrointestinal system. It is characterized by frequent, repeated episodes of uncontrolled vomiting and abdominal pain in patients who chronically use cannabis. These episodes are generally partially improved with bathing in hot water.[18,22]

The pathophysiology is not well understood. Although, it is theorized that cannabinoid receptors in the brain, which have antiemetic functions, are downregulated with chronic cannabis use, and cannabinoid receptors in the GI tract delay gastric emptying, thus contributing to vomiting.[18] Additionally, THC increases splanchnic blood flow that could contribute to gastrointestinal symptoms that are relieved by hot showers, which reduce splanchnic blood flow.[28] Treatment for the condition focuses on correction of electrolyte abnormalities, supportive care for intractable emesis and nausea, and cessation of cannabinoid use.[18]

Endocrine Effects

While there are not strong studies in adolescents regarding the endocrine effects of cannabis use, there are two potential effects under study that are worth noting. Animal studies demonstrate that prepubertal exposure to cannabis is associated with pubertal delays in female individuals and decreased pubertal growth spurt in male individuals.[22] Similarly, limited data indicate a dampened stress response among cannabis users as compared to normal controls. Most of this data comes from adult studies or animal models with limited data for adolescent patients.

Studies have shown lower morning cortisol levels and elevated cortisol levels in the evening, suggesting disruptions in cortisol fluctuations during the day.[22] The potential impact on pubertal development and decreased stress responsiveness with heightened stress hormone levels is under investigation and, as of yet, a clinical implication is unknown.

DISCUSSION

The rise in availability and potency of cannabis products with increasing legalization presents a growing challenge in the pediatric population, as adolescent perception of the risk of harm from use is on the decline. The well-established negative impact on learning, memory, executive function, and the increased risk for the development of psychosis and schizophrenia later in life are most alarming, as evidence has emerged that these effects are not fully reversible even with cessation. Cannabis use can have a detrimental effect on school performance and future academic and career

achievement as a result of these effects. Additionally, emerging evidence of negative effects on the pulmonary, cardiovascular, and endocrine systems provide further cause for concern regarding adolescent health.

As use of legalized cannabis increases in US households and dispensaries become more prevalent in communities, the routine use of cannabis in its various forms is increasingly normalized. This has the greatest impact on impressionable young people. The success of educational interventions aimed at changing adolescent perception regarding risk of harm associated with cannabis products and decreased likelihood to use is encouraging. Working to promote healthy habits and abstinence from cannabis products among young people will require the involvement of pediatricians, educators, community leaders, policymakers, and legislators. Pediatricians can play a key role in disseminating education to patients and families regarding the long-term health risks.

It is worth mentioning that nearly all the long-term negative effects of cannabis use are more pronounced when use starts earlier in adolescence. The neurodevelopmental surge that occurs during adolescence provides a window of increased risk when the deleterious effects of cannabis use seem to be most pronounced.[23] It is critical that pediatricians and pediatric care providers attempt to intervene early in adolescence to combat the benign perception of cannabis use with thorough anticipatory guidance and education on the risk of this behavior.

Multifaceted public health efforts targeted at increasing knowledge about these health impacts are also advisable. Strategies can include school-based education efforts, community-based programming, and legislative efforts to promote awareness and shield children and adolescents from marketing and public use.

Ongoing and future studies that further elaborate the health risks associated with cannabis use will continue to sharpen our understanding of its impact on adolescent health and inform strategies to decrease use in the adolescent population.

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