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Smoking *Cannabis* is Especially Dangerous for Youth Diagnosed with Attention Deficit/Hyperactivty Disorer (ADHD)

Roger W Apple[1*], **Donald E Greydanus**[1] **and Joav Merrick**[2-6]

[1]*Department of Pediatric and Adolescent Medicine, Western Michigan University Homer Stryker MD School of Medicine, Kalamazoo, Michigan, USA*

[2]*National Institute of Child Health and Human Development, Jerusalem*

[3]*Office of the Medical Director, Health Services, Division for Intellectual and Developmental Disabilities, Ministry of Social Affairs and Social Services, Jerusalem*

[4]*Division of Pediatrics, Hadassah Hebrew University Medical Center, Mt Scopus Campus, Jerusalem, Israel*

[5]*Kentucky Children's Hospital, University of Kentucky School of Medicine, Lexington, Kentucky, USA*

[6]*Center for Healthy Development, School of Public Health, Georgia State University, Atlanta, USA*

***Corresponding author:** Apple RW, PhD, Assistant Professor, Department of Pediatric and Adolescent Medicine, Western Michigan University Homer Stryker MD School of Medicine, 1000 Oakland Drive, Kalamazoo, MI 49008-1284, United States. E-mail: Roger.Apple@med.wmich.edu

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Cannabis and Neurological Functioning

Lifetime prevalence of *cannabis* use is associated with multiple health and psychosocial risk factors and is greater than for all other illicit drugs [1]. For adolescents, this fact, combined with the symptoms associated with ADHD, makes *cannabis* use especially dangerous. Even before considering the impact of ADHD it is important to consider neurological changes that have been identified in adolescents who use *cannabis* compared to those who have not [2-17]. Neurological changes associated with chronic use of *cannabis* by adolescents include: excessive stimulation of cannabinoid receptors that has been shown to interfere with normal pruning of synapses during adolescence [7], asymmetrical increase in the size of hippocampi and amygdalae, enlargement of cerebellum, and thinning of the frontal cortex [9,10]. Regular *cannabis* use at early ages has also been shown to affect normal grey and white matter development, impaired axonal connectivity, and changes in cerebral blood flow [2,3,8,11,18,19].

Structural and functional brain differences have been shown in adolescents who use *cannabis* on a regular basis including inattention, impulsivity, impaired executive function, memory loss, decreased coordination, distorted visuospatial perception, altered awareness of passage of time, decline in intelligence quotient (IQ), and impaired novel learning [3-6]. Other studies suggest that the prevalence of *cannabis* abuse is increased in those with attention deficit hyperactivity disorder (ADHD) versus that found in the general population though the complexities of this relationship require more research [17,20-23]. This opinion is not trying to resolve the issue of whether or not those with ADHD are self-medicating or if the impulsive symptoms of ADHD contributed to *cannabis* use, but rather, that *cannabis* smoking combined with youth diagnosed with ADHD is dangerous.

Heritability of *cannabis* use among adolescents has also been discussed as problematic. One study reported that genetic factors were responsible for 40% of individual differences in *cannabis* initiation for adolescents but also acknowledged that environmental influences do increase with age [24]. This supports that a genetic predisposition exists for early initiation which could subsequently lead to the exacerbation of psychosocial and health risk factors [1]. Due to the vulnerability of these risk factors during adolescence, efforts at prevention during and before the adolescence developmental period, is paramount.

Cannabis and ADHD

Linking *cannabis* and ADHD is widely described in the literature [22,23,25,26]. One study found that 34% of adolescents receiving inpatient treatment for problems related to drug dependence were diagnosed with ADHD [22] and another found that males with ADHD and conduct disorder are at an increased risk for early initiation of substance use (including *cannabis*) [23]. With *cannabis* use and ADHD often co-occurring it is not surprising that many diagnosed with ADHD may turn to *cannabis* for self-medication according to some research [25]. *Cannabis* use is also associated with poorer levels of adolescent decision making, conduct disorder, and risky sexual behavior [26] all of which could negatively impact symptoms associated with ADHD. There is widespread belief that *cannabis* use improves mental health symptoms such as anxiety. While there may be empirical support for such claims it is important to note that *cannabis* is not a drug that will improve all aspects of mental health functioning, in fact, it can exacerbate problems such as cocaine-induced paranoia and other psychotic symptoms [27,28]. All of these factors clearly illustrate the hazards for youth diagnosed with ADHD should they decide to smoke *cannabis*.

Family influences cannot be ignored when discussing the dangers of *cannabis* use for youth diagnosed with ADHD [29-31]. Family factors found to contribute to *cannabis* use amoung youth include: permissiveness toward drug use, perception of parental control, social ties to parents, coercive family interaction, family integration, family stress, family income, adolescent disclosure, family activities, parental solicitation, parental knowledge of drug use, and parental monitoring [32-36]. Another study found additional family and peer influences in predicting *cannabis* use among adolescents including drinking to intoxication, peers who have experience with drugs, frequency of father's alcohol intoxication, and aggressive behavior with initiation of smoking by age of 12 as the most powerful predictor of *cannabis* use [37]. It should go without question that combining these factors along with problems with attention, concentration, impulsivity, and hyperactivity are a recipe for disaster.

Providers should understand that considerable research has shown that the developing brain, with its high neuronal plasticity, is vulnerable to exposure to exogenous cannabinoids, particularly during the adolescence developmental period [2-17]. Research also suggests that early imitation of *cannabis* use can increase risks for cognition

dysfunction, CNS changes, neuropsychiatric disorders, *cannabis* dependence, and consumption of additional illicit drugs [15,26]. All of these factors combined with the symptoms of ADHD should be of great concern to treating providers and awareness of this dangerous combination of factors could lead to improved identification, earlier treatment, and better outcomes.

Care Managers

Treatment and intervention services for youth diagnosed with ADHD who are also using *cannabis*, and may also be experiencing a myriad of psychosocial stressors, often proves exceedingly difficult; particularly if the physician is practicing independently with little or no ancillary staff. In an excellent study conducted by Ciccone, et al. [38] the introduction of care managers was evaluated in regard to health care management for patients with heart disease and diabetes. While this is a very different population than the one being discussed, the concept of care managers could potentially provide significant help in treatment and intervention. The results of their study found that utilizing care managers helped patients take a more active role in their treatment, in fact, making the patient the center of treatment. They also found care managers helped create partnerships among physicians and patients and worked to empower patients. These very concepts could be a significant help when applied to adolescents struggling with concentration and drug use issues. What care manager models represent are changes to the medical team, delivery of service, and the hope for improved outcomes which is exactly what could be beneficial for adolescents struggling with ADHD and *cannabis* use.

Conclusion

Smoking *cannabis* is dangerous for youth diagnosed with ADHD. When taking into account the documented neurological impact of smoking *cannabis*, combined with the vulnerability of early initiation, and the symptoms associated with ADHD, it is hard to argue that *cannabis* smoking is anything but high risk for youth diagnosed with ADHD. It is important to note the complexities revolving around such a topic as the dangers of *cannabis* smoking cannot be thought of as dichotomies or even in linear terms or the complexities would be lost. As mentioned above, there is research illustrating the health benefits of *cannabis* use; however, the opinion presented has research illustrating the dangers of smoking *cannabis* for youth diagnosed with ADHD. Though more research is needed to understand the effects of *cannabis* on the developing brain, adolescence is an especially dangerous time to smoke *cannabis* [39,40].

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