Marijuana: A Continuing Concern for Pediatricians

ABSTRACT. Marijuana, the common name for products derived from the plant Cannabis sativa, is the most common illicit drug used by children and adolescents in the United States.1 Despite growing concerns by the medical profession about the physical and psychological effects of its active ingredient, Δ-9-tetrahydrocannabinol, survey data continue to show that increasing numbers of young people are using the drug as they become less concerned about its dangers.1

Because the decision of whether to use marijuana is usually made by the time a young person reaches the age of 19 years,2,3 pediatricians must continue to be cognizant of the implications of marijuana use. Widespread debate exists about marijuana and the possibility of legalizing its use or at least decriminalizing its possession.4–7 Furthermore, marijuana is being promoted for medical purposes, such as the treatment of glaucoma and the management of nausea and anorexia related to cancer chemotherapy.4,8,9 Although these topics are beyond the scope of this statement, evidence suggests that pediatricians should continue their vigilant efforts to prevent the use of this drug by young people.

The abuse of marijuana by adolescents is a major health problem with social, academic, developmental, and legal ramifications.10 Marijuana is an addictive, mind-altering drug capable of inducing dependency.11 Pediatricians are obligated to develop a reasoned approach to dealing with its use by children and adolescents so they can provide appropriate care and counsel.12

EPIDEMIOLOGY

Between 1991 and 1997, the use of marijuana by young people increased dramatically.1 In 1997, 23% of eighth graders reported having used the drug at some time in their lives, an increase in use from 10% in 1991. Among 10th graders, the number nearly doubled from 23% in 1991 to 42% in 1997. In 1997, 50% of high school seniors reported having used marijuana compared with 37% 6 years earlier. The abuse of marijuana among teenagers has increased as the “perceived harmfulness” of regular use has decreased and the perception of “peer acceptance” has increased.1,2

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

POTENCY

The potency of marijuana is defined as the percent-age of Δ-9-tetrahydrocannabinol (Δ-9-THC) in the dry weight of the sample. Increased sophistication in the selective breeding of marijuana plants has led to a substantial increase in the potency of street samples during the past 2 decades. In 1975, the average potency of THC in confiscated samples was 0.71%; by 1997, the average concentration was 3.71%—a fivefold increase. There is wide variation in the potency of smoked marijuana. Sensimilla (considered by many to be the finest product, produced from the flowering tops of the female hemp plant) had an average potency of 6.6% in 1997. Marijuana sold as loose plant material (leaves, stems, and seeds) had an average potency of 3.2%.13 In addition, the method of consumption (smoking as a rolled cigarette or in a pipe or packed into a hollowed-out cigar), as well as the presence of adulterating substances, affect the potency.

Because of the documented change in potency, pediatricians must be able to address with their patients what seems to be “casual use” of marijuana. Trends suggest that the low-dose, self-experimentation type of use typical of the 1960s may be giving way to the high-potency–high-reward pattern of compulsive marijuana use prevalent during the late 1990s.14

SOMATIC CONSEQUENCES

Marijuana should not be considered an innocuous drug. Regular use has been associated with cardiovascular, pulmonary, reproductive, and immunologic consequences. The physiologic effects of marijuana use include an accelerated heart rate and a minimal rise in blood pressure.15,16 These effects, which seem to be secondary to Δ-adrenergic vascular mechanisms, are transient and usually not deleterious to the otherwise healthy adolescent. The immediate pulmonary effect of smoking marijuana is bronchodilation, although with long-term use the smoked particles act as an irritant, causing bronchoconstriction and eventual airway obstruction.17–19 The chronic effects are similar to those of smoking tobacco, and there seems to be a relationship between smoking marijuana and neoplastic changes in the lungs.20

Heavy marijuana use may be especially dangerous for adolescents during puberty. Such use has been associated with diminished sperm motility, decreased sperm counts, decreased circulating testosterone levels,21,22 irregular ovulation, and decreased pituitary gonadotropin levels.23,24 The metabolites of...
marijuana cross the human placenta and are also found in human milk. Although the consequences of the presence of such metabolites in human milk have yet to be identified, infants born to mothers who smoke marijuana during pregnancy are shorter, weigh less, and have smaller head circumferences at birth. Marijuana and some of its components influence the immune system and affect the body’s antitumor activities. Marijuana receptors have been identified on macrophages and T and B lymphocytes, suggesting a molecular basis for immunosuppression by THC.

**NEUROPHARMACOLOGY**

The psychoactive effects of Δ-9-THC are receptor-mediated. The cannabinoid receptor sites in the brain are particularly dense in the outflow nuclei of the basal ganglia, the hippocampus, and the molecular layers of the cerebellum, implicating roles for cannabinoids in the disruption of cognition and coordination. Sparse densities in the lower brainstem areas controlling cardiovascular and respiratory functions may explain why high doses of Δ-9-THC are not lethal.

Anandamide, a derivative of arachidonic acid, is an endogenous chemical in the brain that binds with cannabinoid receptors. Like Δ-9-THC, it has been shown to affect muscle coordination, produce analgesic and tranquilizing effects, and inhibit secretion of follicle-stimulating hormone, prolactin, and growth hormone. The use of anandamide as a marijuana antagonist has substantial effects on rats conditioned to self-treatment with THC and has helped elucidate the mechanism by which cannabinoids exert their biological and psychologic effects.

The most pervasive common pathway among drugs of abuse, including cocaine, heroin, opiates, and marijuana, is the stimulation of release of the neurotransmitter, dopamine. This endogenous catecholamine stimulates certain dopaminergic projections of the medial forebrain bundle—the brain’s so-called reward circuitry. Psychoactive drugs, including marijuana, derive substantial abuse liability from enhancing these circuits; and it is the psychoactive ingredient of marijuana, Δ-9-THC, that stimulates the release of dopamine, mediated through the cannabinoid receptors.

In both animal and human experiments, subjects self-administer marijuana. They predictably select high-potency marijuana over low-potency marijuana, supporting the hypothesis that the reinforcing effect and abuse liability of marijuana are positively related to the Δ-9-THC content.

Marijuana is lipophilic and is stored in the brain and other fat-rich areas of the body, forming what has been described as a “depot.” The slow release of marijuana and its metabolites from lipid stores may explain the carry-over effects of marijuana on driving and other cognitive and behavioral changes as well as the absence of acute signs of withdrawal after abrupt discontinuation of use.

**BEHAVIORAL AND COGNITIVE CONSEQUENCES**

Marijuana affects the brain, resulting in behavioral and cognitive effects. Acutely, marijuana produces euphoria, relaxation, and disinhibition. Persons under the influence of the drug show impaired problem-solving skills and difficulty in organizing thoughts and conversing. Other adverse consequences of marijuana use include interference with coordination; the ability to judge elapsed time, speed, and distance; the ability to track a moving object; and reaction time. There is little doubt that marijuana intoxication contributes substantially to accidental deaths and injuries among adolescents, especially those associated with motor vehicle crashes, and is frequently involved in incidents related to driving while intoxicated.

Regular use of marijuana also exerts a negative effect on short-term memory, learning, and attention span. Three methodologically strong studies presented compelling evidence that these functions were impaired in frequent users of marijuana (defined as using 20 to 30 days per month), even up to 6 weeks after discontinuation of use, and noticeable impairment in attention and memory was evident even after 24 hours of abstinence. Clearly, young people who are frequent users of marijuana experience residual neuropsychologic effects with an impaired ability to learn.

An “amotivational syndrome” has been described in chronic heavy marijuana users. This syndrome is characterized by the inability to sustain attention on environmental stimuli and to maintain goal-directed thinking and behavior. An additional source of concern is the occasional occurrence of dysphoric reactions that may range from mild fear to depersonalization to frank paranoia.

Finally, marijuana use often precedes the use of other more dangerous drugs. Although marijuana use does not necessarily predict progression to the use of “harder” drugs, adolescents who use marijuana are 104 times as likely to use cocaine compared with peers who never smoked marijuana. Therefore, the use of marijuana as a risk behavior and its role as a “gateway drug” for some teenagers must be considered.

**SUMMARY**

The seriousness of the behavioral consequences of marijuana use is sufficient to cause great concern and should prompt the pediatrician to counsel young people against any use of the drug. Such counsel should be based on health concerns, including the relationship of marijuana use to trauma associated with intoxication and the effect on memory and learning during this important period of development. Additional reasons for concern and counsel include anxieties and uncertainties about the potential harm that marijuana use may cause to adolescents during a period of rapid change in hormonal secretion, possible teratogenicity, and the known consequences of long-term use.

A discussion of drug use, including the use of marijuana, should be a routine part of primary health care evaluations.
care clinical preventive services for every child and adolescent. An assessment of potential drug use gives the pediatrician the opportunity to offer anticipatory guidance before the onset of drug use, to intervene and minimize consequences if drug use has begun, and to detect and address issues of long-term or heavy use.

Although all users should be counseled about the dangers of the drug and the illicit nature of its use, marijuana is an addictive drug and is capable of producing dependence. Marijuana-dependent teenagers should be offered treatment options, rather than simply punishment, for their illness.

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