



# The Impact of Marijuana Policies on Youth: Clinical, Research, and Legal Update

Seth Ammerman, MD, FAAP, Sheryl Ryan, MD, FAAP, William P. Adelman, MD, FAAP,  
THE COMMITTEE ON SUBSTANCE ABUSE, THE COMMITTEE ON ADOLESCENCE

This technical report updates the 2004 American Academy of Pediatrics technical report on the legalization of marijuana. Current epidemiology of marijuana use is presented, as are definitions and biology of marijuana compounds, side effects of marijuana use, and effects of use on adolescent brain development. Issues concerning medical marijuana specifically are also addressed. Concerning legalization of marijuana, 4 different approaches in the United States are discussed: legalization of marijuana solely for medical purposes, decriminalization of recreational use of marijuana, legalization of recreational use of marijuana, and criminal prosecution of recreational (and medical) use of marijuana. These approaches are compared, and the latest available data are presented to aid in forming public policy. The effects on youth of criminal penalties for marijuana use and possession are also addressed, as are the effects or potential effects of the other 3 policy approaches on adolescent marijuana use. Recommendations are included in the accompanying policy statement.

## abstract

*This document is copyrighted and is property of the American Academy of Pediatrics and its Board of Directors. All authors have filed conflict of interest statements with the American Academy of Pediatrics. Any conflicts have been resolved through a process approved by the Board of Directors. The American Academy of Pediatrics has neither solicited nor accepted any commercial involvement in the development of the content of this publication.*

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

*Technical reports from the American Academy of Pediatrics benefit from expertise and resources of liaisons and internal (AAP) and external reviewers. However, technical reports from the American Academy of Pediatrics may not reflect the views of the liaisons or the organizations or government agencies that they represent.*

*All technical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.*

[www.pediatrics.org/cgi/doi/10.1542/peds.2014-4147](http://www.pediatrics.org/cgi/doi/10.1542/peds.2014-4147)

DOI: 10.1542/peds.2014-4147

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2015 by the American Academy of Pediatrics

## EPIDEMIOLOGY OF MARIJUANA USE AMONG YOUTH

Three major US national databases track substance use over time, including use of marijuana: Monitoring the Future (MTF),<sup>1</sup> sponsored by the University of Michigan and the National Institute of Drug Abuse; the Youth Risk Behavior Survey (YRBS),<sup>2</sup> sponsored by the Centers for Disease Control and Prevention; and the National Survey on Drug Use and Health (NSDUH),<sup>3</sup> sponsored by the Substance Abuse and Mental Health Services Administration. Although each database uses different methods, all track and analyze substance use trends. MTF annually surveys approximately 50 000 middle and high school students (12th graders since 1975, and 8th and 10th graders since 1991). Data from MTF 2014 revealed that 6.5% of 8th graders, 16.6% of 10th graders, and 21.2% of 12th graders used marijuana at least once in the past 30 days (“current use”). Current use rates peaked in 1996 for 8th graders at 11.3% and in 1997 for 10th and

12th graders at 20.5% and 23.7%, respectively. Current use rates decreased for all grades from 2013 to 2014, although not in a statistically significant manner. All rates remain lower than the peak rates in the 1990s. Daily use rates for 8th, 10th, and 12th graders in 2014 were 1.0% of 8th graders, 3.4% of 10th graders, and 5.8% of 12th graders; previous peak rates were 1.3% (2002), 3.9% (2002), and 6.6% (2011) for 8th, 10th, and 12th graders, respectively. Daily use rates decreased for all grades in 2014, with the decrease in 10th graders' use statistically significant. Rates of current marijuana use in the YRBS 2011 data were not significantly changed in 2013: 23.1% and 23.4%, respectively. In addition, the Partnership Attitude Tracking Study, sponsored by the MetLife Foundation and the Partnership at DrugFree.org, found in their most recent survey, in 2012, that in a school-based sample of teenagers in grades 9 through 12, 8% reported smoking marijuana heavily (at least 20 times) in the past month. Although this rate decreased from 9% in 2011, there has been a significant increase from 5% in 2008.<sup>4</sup> NSDUH 2012 data revealed current use rates were 8.2% in 2002, 6.7% in 2006 and 2007, 7.3% in 2009, and 7.9% in 2011 for 12- through 17-year-olds. Marijuana current use rates increased for 18- through 25-year-olds each year from 2008 through 2011, from 16.5%, 18.1%, 18.5%, and 19.0%, respectively; 2012 rates remained at 19.0%. Approximately 100 million adult Americans have ever used marijuana, with a current use rate of 17.4 million.<sup>5</sup>

As noted, MTF and NSDUH are national databases. State-specific data are available for many states through their use of the YRBS or equivalent. Using this YRBS data, it is possible now to compare use rates for states with medical marijuana laws to national levels. Since legislation allowing medical marijuana took effect across a number of states, there

have been no significant increases or decreases in youth use rates, with the exceptions of Alaska and New Mexico (see Appendix). Whereas Alaska has reported a significant decrease (8.5%) in current youth use rates since legislation took effect in 1998, New Mexico has reported a significant increase between 2011 and 2013 in 12th graders only. Additionally, 2 recently published studies have similarly found no significant differences in current use rates after legislation<sup>6</sup> or only differences in 2 states (Montana decreased, Delaware increased) that can be explained equally by chance.<sup>7</sup>

A number of factors may affect youth use rates in the future, including perceived harm of marijuana use, pertinent norms endorsed by youth, and parenting behaviors related to youth marijuana use. Youth rates may also be influenced by specific components of marijuana policies (eg, locations and numbers of medical marijuana dispensaries in a given locale, regulations of their operation, and how legalization of marijuana for nonmedical purposes is operationalized).

## DEFINITIONS

### Cannabinoids

Cannabinoids are biologically active molecules that bind to receptors in the human body. Humans produce endocannabinoids, including anandamide and 2-arachidonoylglycerol, which bind the receptors known as CB1 and CB2. Both naturally occurring and synthetic cannabinoid molecules can bind these human endocannabinoid receptors and have biologic activity. Currently, cannabinoid biology is poorly understood. Research has identified areas of therapeutic potential for these molecules, including analgesia in chronic neuropathic pain, appetite stimulation in debilitating disease, and spasticity in multiple sclerosis. However, adverse effects can also

occur, ranging from benign (eg, tachycardia and palpitations) to serious (eg, mood, anxiety, and thought disorders). There are 2 cannabinoid pharmaceutical products approved by the US Food and Drug Administration. Controlled studies suggest that pharmaceutical preparations that combine cannabinoids with varying affinities for the CB1 and CB2 receptors appear to be able to deliver therapeutic effects while protecting against adverse effects.

### Marijuana

*Marijuana* refers to the dried leaves and flowers of the cannabis plant, which contains a large number of biologically active cannabinoids. There are numerous species and subspecies of cannabis. Leaves of the plant are smoked, vaporized, or cooked to extract cannabinoids, which can then be ingested for their pleasurable psychoactive effects. Cannabinoids from marijuana may also produce therapeutic benefits, which has led to the use of marijuana as a medication. However, marijuana is a complex mixture of cannabinoids (more than 200 have been identified) and other molecules, and the risk-benefit ratio of this mixture has not been well defined. Over the past several decades, selective breeding of marijuana species has resulted in higher concentrations of cannabinoids in the plant, resulting in a more potent psychotropic effect and possible increased risk of adverse effects. Any product that requires smoking to release the desired effects cannot be recommended by physicians, because smoke contains tar and other harmful chemicals. Alternative methods of administration of cannabis without combustion have been developed.

### Tetrahydrocannabinol

Tetrahydrocannabinol (THC) is the primary psychoactive cannabinoid in the marijuana plant. The amount of THC in a given plant varies widely,

depending on the species and subspecies of marijuana used in breeding the plant.

### Hemp

A low-THC strain of *Cannabis sativa*, hemp, is not used for psychoactive effects. Rather, hemp is used to make a variety of consumer products, including paper, textiles, clothing, health food, and biofuel. Commercially available hemp products (eg, hemp milk) are devoid of cannabinoids. Hemp is legally grown in a number of countries, including Spain, China, Japan, Korea, France, and Ireland.

### MARIJUANA BIOLOGY

There are various species of marijuana, but the 2 most common species used for “medical marijuana” are *Cannabis sativa* and *Cannabis indica*.

Psychotropically, *Cannabis sativa* typically causes increased alertness and an energetic sense, whereas *Cannabis indica* is reported to cause more of a sense of relaxation and, in some cases, lethargy. However, both species have been hybridized repeatedly, and a typical plant will have varying amounts of both sativa and indica.<sup>8</sup> Regardless of the species, the main known active ingredients responsible for the desired medicinal effects are THC; cannabidiol (CBD), a nonpsychoactive cannabinoid; and arachidonoyl ethanolamide (anandamide), an endogenous ligand that is involved in binding THC and CBD to endocannabinoid receptors.<sup>8</sup> These and other cannabinoids form a complex mix that bind to CB1 and CB2 with varying affinity. These active compounds bind to the body’s endocannabinoid receptors, which are found throughout the body. There are 2 major endocannabinoid receptors: CB1, found in the brain and nervous system, and CB2, found in the immune system.<sup>8</sup>

### Side Effects of Marijuana Use

The most consistent physical side effects are an increase in heart rate and systolic blood pressure. Other

side effects include conjunctival injection, dry mouth, orthostatic hypotension, increased appetite, increased thirst, drowsiness, insomnia, anxiety symptoms, panic attacks, short-term memory loss, hallucinations, and ataxia.<sup>9</sup> There is no specific antidote for marijuana intoxication, but in cases of severe anxiety symptoms or a panic attack, treatment with a benzodiazepine may help,<sup>9</sup> and supportive treatment is used for oversedation.<sup>10</sup> Ischemic stroke in young people has also been reported.<sup>11</sup> No fatalities have ever been reported as solely attributable to a marijuana overdose; however, ingestion of marijuana by children can result in a variety of symptoms, including drowsiness, ataxia, nystagmus, hypothermia, and hypotonia. Respiratory depression or coma has rarely been reported.<sup>12</sup> Since the legalization of medical marijuana in Colorado, a number of reports of children with toxic ingestions have occurred.<sup>10</sup> Treatment with activated charcoal to prevent absorption of the marijuana may be helpful in specific severe situations if there is no concern about level of consciousness and if treatment is initiated well within 2 hours of onset of the ingestion. As with any other prescribed medication for adults, children should not have access to medical marijuana, with the exception of unique circumstances discussed later.

### Impact of Marijuana Use on Adolescent Brain Development

New research on adolescent brain development has found that brain maturation, particularly that of the prefrontal cortex, proceeds into the mid-20s. This maturation includes substantial changes in specialization and efficiency, which occur through myelination and synaptic pruning. Synaptic pruning or refining consists of a reduction in gray matter, primarily in the prefrontal and temporal cortex areas and in subcortical structures through the

elimination of neural connections.<sup>13–15</sup> Increased myelination also occurs, which allows increased neural connectivity and efficiency and better integrity of white matter fiber tracts.<sup>16,17</sup> The prefrontal lobes are the last areas of the adolescent brain to undergo these neuromaturational changes, which, when complete, allow more efficient communication between the higher-order areas of the brain and the lower-order sensorimotor areas.<sup>18,19</sup>

It has been postulated that the developing adolescent brain is particularly at risk for the development of substance use disorders, although a number of factors are involved, including genetic predisposition, environment, and mental health disorders. The earlier the adolescent initiates substance use, the more likely a substance use disorder, such as dependence or addiction, is to occur.<sup>20–25</sup> Now, with newer techniques to study brain structure and function, data are emerging to suggest that the use of marijuana may alter the developing brain, paralleling what has been found in studies on adolescent neurocognitive functioning. For example, studies have shown that adolescents who report regular marijuana use perform more poorly on tests of working memory, visual scanning, cognitive flexibility, and learning.<sup>26</sup> Furthermore, the number of episodes of lifetime marijuana use reported by subjects correlated with overall lower cognitive functioning.<sup>27</sup>

Recently, studies evaluating brain structure have found effects of marijuana use on hippocampal, prefrontal cortex, and white matter volume. Specifically, heavy marijuana users have been found to have greater gray matter volume, particularly in the left hippocampal area, suggesting an interference with synaptic pruning.<sup>28–30</sup> Furthermore, heavy marijuana use was also correlated with poorer verbal and attention performance.<sup>31</sup> Functional

MRI studies examining neural activity in abstinent marijuana users have found abnormalities in activation during cognitive tasks, which are postulated to be correlated with marijuana-related changes seen in cognition and attention, such as deficits in spatial working memory, verbal encoding, and inhibition.<sup>31</sup>

Additionally, use of substances may alter the developing brain itself in ways that are not yet fully understood but are different from usual brain development, and additional studies using multimodal neuroimaging approaches are needed.<sup>32</sup> It is also not clear whether there are critical periods during adolescence when there is heightened vulnerability to substances and whether these changes can be reversed with abstinence or reduced use.<sup>32</sup> However, the documented effects on cognition and the emerging data that correlate these effects with detrimental effects on brain structure and function<sup>33,34</sup> should serve as cautionary evidence to discourage recreational marijuana use in adolescents.

## **CANNABINOID THERAPEUTICS**

### **Pharmaceutical Cannabinoids**

Two legal synthetic forms of cannabinoids are available in the United States and approved by the Food and Drug Administration (FDA); a third is available in the United Kingdom and Canada. The first, dronabinol (Marinol), is a schedule III oral medication approved by the FDA for the treatment of AIDS-related wasting and chemotherapy-induced nausea and vomiting.<sup>35</sup> Dronabinol is a capsule that must be taken whole orally, which may prove problematic in the face of nausea or vomiting. Additionally, the onset of symptom relief with dronabinol is significantly longer than that of smoked or vaporized marijuana. The second, nabilone (Cesamet), is an oral capsule with properties similar to dronabinol but is a schedule II medication because of a possibly higher abuse

potential. Nabilone is also prescribed for spasticity secondary to spinal cord injury.<sup>36</sup>

A third cannabinoid pharmaceutical is known as Sativex, a fast-acting nonsynthetic oral-mucosal spray.<sup>37</sup> Sativex is currently approved in Canada and the United Kingdom for symptomatic relief of neuropathic pain in multiple sclerosis. In Canada, it is also approved as an adjunctive analgesic treatment in patients with cancer pain. Sativex is undergoing late-stage clinical testing in Europe and the United States for similar indications. Sativex contains equal amounts of THC and CBD. Sativex is rapidly absorbed and easy to titrate, which may make it a more effective and easy-to-use medication than dronabinol. Onset of desired effects typically occurs within minutes.

### **Medical Marijuana**

As of December 2014, medical marijuana (cannabis) was legal under state law for adults 21 years and older in 23 states and the District of Columbia (for the list of medical marijuana states and related updates, see the AAP Web site [www.aap.org/marijuana](http://www.aap.org/marijuana)). Cannabis is illegal by federal law and is a schedule I drug under the federal Controlled Substances Act (no legitimate medical use). California was the first state to legalize medical marijuana in 1996. Efforts are under way in a number of additional states to legalize the use of medical marijuana. Specifics of the medical marijuana laws vary by state,<sup>38</sup> but all allow adults to use marijuana for medical purposes, usually for certain specified conditions, if recommended by a physician, although general categories also often include "pain." Minors are able to obtain medical marijuana with parents' written permission (and, in some cases, other restrictions) in most states that have legalized medical marijuana.

### **Marijuana Delivery**

Medical marijuana dispensaries provide marijuana in forms that can

be either smoked through combustion or vaporization or ingested to produce the desired medical effects. Smoking or vaporizing marijuana results in rapid onset (minutes) of desired effects, whereas ingestion results in a more gradual and delayed onset (half hour to several hours). Vaporization is considered less harmful to the lungs, because the marijuana is slowly heated to its vaporization point, releasing THC and water vapor, rather than being burned to its combustion point to release THC (as well as tar and other potentially harmful products in smoke). The dose of THC is the same whether the marijuana is vaporized or burned.<sup>39-41</sup> It should be noted that use of a water pipe to smoke marijuana does not eliminate any of the harmful products in the smoke.

### **Medical Marijuana and Potential Impact on Adolescent Use of Recreational Marijuana**

One concern of parents and pediatricians is whether the legalization of medical marijuana results in increased use of recreational marijuana by adolescents. This concern is multipronged: that legitimizing marijuana as a medication may lead adolescents to believe that marijuana is a safe drug, whether prescribed or not; that access to marijuana will be more widespread; and that there will be efforts to target youth through marketing not only for medical marijuana but also for decriminalized and possibly legal use as well. As an example, the abuse of prescription drugs such as pain relievers, sedatives, tranquilizers, and stimulants for nonmedical purposes is increasing among adolescents and young adults, given increased prescribing practices with these substances.<sup>42</sup>

When all high school data are combined for each state in which medical marijuana is legalized and for which data for current use before and

after medical marijuana legalization are available (14 states to date),<sup>6,7</sup> no state with legalized medical marijuana has shown a statistically significant increase in adolescent recreational marijuana use except Delaware; 2 states (Alaska and Montana) have shown statistically significant decreases. One recent study found that states with medical marijuana laws, on average, reported higher rates of marijuana use in 12- to 17-year-olds over the time period of 2002 to 2008 (8.68%; 95% confidence interval [CI], 7.95–9.42), compared with the average rate reported by 12- to 17-year-olds in all states without such laws—(6.94%; 95% CI, 6.60–7.28).<sup>42</sup> States with legalized medical marijuana also reported lower rates of perception of riskiness of marijuana than states without. However, this study was not able to determine the changes within each individual state with legalized medical marijuana before the passage of the laws compared with after passage of the laws; in fact, in 8 states that passed medical marijuana laws within the time period studied (since 2004), these states already had a baseline rate that was higher than in states without legalized medical marijuana, but no data were provided comparing marijuana use rates for teenagers in those states before and after passage of medical marijuana laws.<sup>43</sup> To date, data have shown that state-specific legalization of medical marijuana has not led to an increase in recreational use of marijuana by adolescents. This relationship is complex, and research and epidemiologic surveillance must continue.

### **Adolescent Use of Medical Marijuana**

There are numerous reports in the popular media by parents regarding the successful use of medical marijuana by adolescents for the treatment of a variety of health conditions, including attention-deficit/hyperactivity disorder, anxiety, depression, and

autism, as well as anorexia, chronic pain, and postchemotherapy nausea and vomiting. There are no data concerning rates of adolescent use of medical marijuana obtained through licensed dispensaries. There are also no published studies on the use of marijuana in the pediatric or adolescent patient populations, with the exception of 1 study evaluating the source of marijuana used by adolescents receiving care in a substance abuse treatment facility. This study found that diverted “medical marijuana” had been used by 74% of the adolescents in the treatment facility.<sup>44</sup>

The American College of Physicians issued a position paper in 2008 emphasizing the importance of sound scientific study to evaluate the role of marijuana in modern medical therapy.<sup>45</sup> Although directly addressing the adult population, the position paper stressed that marijuana was neither devoid of potentially harmful effects nor universally effective.

In 2010, the California Society for Addiction Medicine issued a statement on the medical aspects of marijuana legalization,<sup>46</sup> which addressed the following 7 points:

1. Effective restrictions created to minimize access to marijuana for anyone younger than 21 years
2. Treatment of adolescent marijuana abusers, rather than punishment, made universally available
3. Revenue streams for treatment funded by fees and taxes from marijuana sales
4. Warning labels placed on smokable products
5. Regulation of marketing (advertising), distribution, and sales implemented
6. Evaluation components to document the impact of legalization
7. Technical difficulties documenting driving under the influence to be addressed and clarified

Based on consideration of these points, the California Society for Addiction Medicine concluded that “medical marijuana” is a flawed concept for the following 3 reasons: administering any medication via drawing hot smoke into the lungs is inherently unhealthy; although use of vaporizers, sprays, and tinctures solves problems inherent in smoking, treatment of illness without standardized dose or content of the medication remains a safety issue; and if the public wants to legalize marijuana, there is no reason to force physicians to be gatekeepers in a manner that enables liberal access to marijuana but generally fails to uphold accepted standards of practice for recommending a potentially addicting medication or drug.

### **Research Findings on Pharmaceutical Cannabinoids and Medical Marijuana**

Cannabinoids in all forms and marijuana have been used for a wide variety of pathologic states and diseases, including chronic pain, nausea, anorexia, cancer, autoimmune and rheumatic diseases, inflammatory bowel disease, attention-deficit/hyperactivity disorder, multiple sclerosis and spasticity, depression, anxiety, and posttraumatic stress disorder. There are no FDA safety or efficacy data about marijuana for medical use. The FDA has approved synthetic THC (dronabinol) and nabilone for chemotherapy-induced nausea and vomiting as well as anorexia associated with AIDS, as previously discussed. Two recent articles have reviewed, respectively, current and emerging research on the physiologic mechanisms of cannabinoids and their applications in managing chronic pain, muscle spasticity, cachexia, and other debilitating problems as well as the efficacy of marijuana for treatment of chemotherapy-induced nausea and vomiting.<sup>47,48</sup> Research has demonstrated that cannabinoids are useful in treating anorexia associated

with cancer, nausea and vomiting associated with chemotherapy, chronic pain, and multiple sclerosis.<sup>49-52</sup> A recently published study also demonstrated that current marijuana use was associated with lower levels of fasting insulin, lower homeostasis model assessment-estimated insulin resistance, and smaller waist circumference.<sup>53</sup> Two recently published review articles on medical marijuana for digestive disorders and select neurologic disorders generally noted small numbers of studies and mixed results.<sup>54,55</sup> There are no published studies on the use of cannabinoids or marijuana to treat health conditions in children or adolescents.

### Summary

Cannabinoids may be helpful in adults for certain medical conditions. However, for pediatricians the recommendation of medical marijuana is problematic for the following reasons: It is not regulated by the FDA, its purity and THC content are not consistently verified, and because there are only small case studies available, the risk-benefit relationship cannot be determined. Available data have shown that legalization of medical marijuana has not led to a significant increase in the current use of recreational marijuana by adolescents. Pediatricians may legally recommend the use of medical marijuana in some states, although there are no consistent data supporting the effectiveness of its use in pediatric medical conditions. It is also recognized that in certain unique situations, such as with a serious disease not amenable to usual treatment, or a terminal illness, a pediatrician may recommend marijuana for compassionate medical purposes, on a case-by-case basis, using anecdotal information. Thus, without peer-reviewed studies providing scientific evidence favorable for the use of medical marijuana in pediatric populations, recommending its use would have to be based on an

individual provider's experience, weighing the needs and potential risks for an individual patient.

### LEGALIZATION OF MARIJUANA: US AND INTERNATIONAL EXPERIENCES

In contrast with marijuana decriminalization (ie, no criminal penalties and either no or reduced civil penalties for possession or personal use), *legalization* refers to permitting the growing, sale, and possession of marijuana. Decriminalization and legalization of marijuana have been the focus of global debate and controversy for several decades and continue to be an active concern, particularly as they pertain to the adolescent population. It is still illegal to possess and consume, cultivate, and sell cannabis in almost all countries throughout the world, although a number of countries have adopted actual or de facto policies of decriminalization of possession. In many cases, the reluctance of nations globally to change the illegal status of drug-related activities results in part from international commitments and treaties, which oblige them to adhere to drug prohibition policies.<sup>56</sup>

The 3 nations that can provide the most information and insight into experiences with and consequences of liberal marijuana laws are Uruguay, Portugal, and the Netherlands. In 2013, Uruguay became the first country in the world to legalize the cultivation, sale, and use of marijuana for both recreational and medicinal purposes, in response in part to the large illegal and crime-associated drug trafficking occurring in that country.<sup>57</sup> At this point, it is too early to determine the effect of such a law on the use of marijuana and the anticipated decrease in drug-associated violent crime in Uruguay and its neighboring countries, but there is keen interest in how this law will play out.

In 2000, Portugal officially abolished all criminal penalties for the personal

use and possession of all illicit drugs, including marijuana, cocaine, heroin, and amphetamines.<sup>58</sup> Although falling short of outright legalization, this country has opted to pursue a public health approach to the problem of substance use, moving those using drugs from the criminal justice system to the public health and medical system. For example, in exchange for jail time, any person caught using or possessing drugs is required to appear before a provincial "dissuasion committee" made up of an attorney and 2 health professionals, including a social worker. The committee's task is to determine whether the person's use is limited to recreational use or meets criteria for addiction. Each committee can take an individualized approach to each case and has the ability to determine which sanctions to apply, such as warnings, fines, license suspension, or, in the case of drug addiction, the requirement for drug treatment. In the latter case, the person is offered drug treatment as an alternative to a fine or suspension of his or her driver's license; failure to comply with treatment can result in referral to criminal court.<sup>59</sup> Studies suggest that it has been difficult for jurisdictions to enforce the requirement for treatment and to enlist the assistance of local physicians in using these committees for their patients with substance use disorders.<sup>58</sup> However, proponents of this legislation have cited several statistics demonstrating that in the first 5 years after passage of this legislation, reduced levels of drug use by teenagers, decreased rates of HIV infection through injection drug use, and a doubling in the rates of people seeking treatment for substance use disorders were observed.<sup>60</sup>

The Netherlands has also taken a liberal view toward criminal prosecution of cannabis users, although it is still officially illegal to possess, use, sell, and cultivate marijuana in that country. As signatory to a number of

international anti-drug use treaties, the Netherlands is obliged to maintain the illegality of the use and possession as well as trafficking and manufacture of all illicit substances (prohibition), including all those related to the cannabis plant. However, through the Opium Act of 1976, the Netherlands attempted to make a clearer distinction in their view between drugs such as cocaine, heroin, lysergic acid diethylamide, ecstasy, and mushrooms, which were felt to have an unacceptable public health risk, and hashish and marijuana, which were thought to entail less overall risk.<sup>61</sup> Thus, strict criminal penalties are maintained for possessing, dealing in, and selling for large-scale drug trade in these drugs. In contrast, the sale of marijuana in “coffeehouses” throughout the country is tolerated, as long as they adhere to a number of restrictions. For example, they cannot advertise, be located near international borders, sell amounts greater than 5 g to any person, sell any illicit substances other than marijuana, and sell to anyone younger than 18 years old.<sup>62</sup> The public smoking of marijuana is also discouraged, although it is not viewed or treated as a criminal offense.

Of note, the rate of marijuana use did increase among adolescents after the passage of these acts but was not thought to be sufficient to repeal or change the laws regarding youth access.<sup>63</sup> Recently, however, because of increases in what has been determined to be international “drug tourism,” the Dutch government refined the laws such that “coffeehouses” are run more as private clubs, and only Dutch citizens are allowed to purchase marijuana through them.<sup>64</sup> In 2012, a judge upheld a government plan to ban foreign tourists from buying marijuana by introducing a “weed pass” available only to Dutch citizens and permanent residents. Worried that tourism will take a hit, Amsterdam’s mayor, Eberhard van

der Laan, worked out a compromise with the national government, which relies on municipalities and local police to enforce its drug policies.<sup>65</sup> The Dutch government has recently decided to reclassify high-strength cannabis (>15% THC containing) into the same category as cocaine or heroin, meaning that the “coffeehouses” will not be able to sell this product, and only the lower-strength cannabis will be available.<sup>66</sup>

#### **DECRIMINALIZATION OF MARIJUANA: US AND INTERNATIONAL EXPERIENCES**

Decriminalization of marijuana typically is defined as the reduction of criminal offenses for the possession of small amounts of the marijuana plant to a misdemeanor, infraction, or civil penalty (eg, similar to a parking or speeding ticket) rather than a felony charge. In addition to Portugal and the Netherlands, a number of other countries have opted to decriminalize the use and possession of marijuana for individual use, although the specific policies vary widely across nations. For example, several South American countries (ie, Venezuela, Argentina, Columbia, and Peru) have tolerated the use and possession of “small amounts” (<1 g) of marijuana (not the sale or trafficking) or have effectively abolished requirements for jail time or fines for possession.<sup>67</sup> In some cases, countries require mandatory drug treatment and rehabilitation for any use (eg, Venezuela, Argentina, and Brazil).<sup>67,68</sup> In Brazil, Bolivia, Ecuador, and Paraguay, recreational use is illegal.<sup>67,68</sup> Chile specifically allows private growing and possession for recreational use or medical conditions but specifically prohibits group use, buying, and trafficking.<sup>69</sup>

Canada, along with several European countries, likewise tolerates the use or possession of small amounts of marijuana by individuals and has also legalized medical marijuana use.<sup>70</sup> The definition of “a small amount”

varies between 3 and 30 g depending on the country. Furthermore, in some cases use is designated as a misdemeanor without prison terms (eg, Hungary).<sup>70</sup> Czechoslovakia recently passed laws decriminalizing the use of all drugs, in much the same way as Portugal did in 2000.<sup>71</sup> Most Asian nations still do not make a distinction between use or possession of small amounts and the selling of or trafficking in larger quantities—all of which can carry stiff penalties including fines or significant prison sentences. In rare cases (eg, China and Saudi Arabia), executions have taken place.<sup>72,73</sup>

Since 1937, the US federal government’s approach has remained that of prohibition, meaning that its laws and its participation in international treaties have upheld the illegal status of use, possession, cultivation, and sale of marijuana. These laws also provide the basis for efforts to deter individual use, as well as interdiction efforts aimed at large-scale selling, smuggling, and trafficking of all illicit drugs.<sup>74</sup> Despite the fact that there are no significant plans of the current US administration to change this position, 18 states currently (2014) have laws that have decriminalized the individual use and possession of marijuana,<sup>75</sup> and 4 states and the District of Columbia, have legalized nonmedical use, marketing, and sales of marijuana for adults.

In 2009, the Justice Department announced that the federal government would not prosecute medical marijuana providers and consumers who were in compliance with state laws. Subsequently, in 2013 the Justice Department also announced that it would not interfere with the legalization laws in Washington State and Colorado. Eighteen states have decriminalized the use and possession of small amounts (usually ≤1 ounce, although amounts vary by state) of marijuana for personal use; see [www.aap.org/](http://www.aap.org/)

marijuana for the list of states and latest updates. The specifics of the laws vary across states, as does the degree to which these laws are enforced at the local level. Although arrests still occur, penalties are minor and range from first offenses resulting in no penalty to fines that may increase with subsequent offenses, and, in some cases, requirement for treatment or rehabilitation. In other cases, offenses have been reduced to civil violations, resulting in fines or requirements for educational programs.<sup>75</sup> The key aspect from the standpoint of decriminalization is that although these offenses are considered “criminal,” the level of offense has been reduced to a misdemeanor or an infraction rather than a felony charge, which carries higher immediate criminal consequences, such as prison time. Felonies also carry significant long-term collateral consequences, such as the inability to obtain student loans, stigma related to employment, and the inability to vote.

## **ARGUMENTS FOR AND AGAINST LEGALIZATION OR DECRIMINALIZATION OF MARIJUANA**

### **Legalization**

Because Uruguay is the only country that has officially legalized the sale and possession of marijuana, there are no available studies evaluating the effect of this action on use by adolescents and young adults. In response to the ongoing debate about this issue, however, arguments have been put forth both for and against legalization. Proponents of legalization sometimes claim that marijuana is a benign substance, with low rates of dependence and physical or behavioral effects, and that legalization would reduce illegal trade and the crime associated with it by instituting regulations.<sup>76</sup> Furthermore, proponents argue that these regulations would provide significant and needed monetary resources, through taxation, and

would reduce the use of resources for interdiction.<sup>76</sup> In terms of effects on adolescents, proponents of legalization also argue that the requirement for selling only through licensed stores, as with tobacco and alcohol, with penalties for those selling to minors, would limit the amount of marijuana available to youth.<sup>76</sup>

Proponents of legalization also cite reports from the United Nations Office on Drugs and Crime that have concluded that efforts to control the large-scale production and trafficking of illegal drugs not only have been futile but have not taken into account the human and economic toll that incarceration for drug-related crimes has had on individuals, families, and societies.<sup>77</sup> And because the primary approach to resolving illicit drug problems has emphasized law enforcement, it has been difficult for the public health community to respond appropriately to the medical problems of dependence and addiction and their role in drug-related offenses, such as intoxicated driving by minors.<sup>77</sup>

Opponents of legalization cite a number of concerns specifically about youth and young adults. For example, there is significant concern that the legalization of marijuana will open the floodgates of marketing, with much of that being subtle marketing toward youth, even though any such legalization laws would be expected to apply only to adults older than either 18 or 21 years. The experience with the alcohol and tobacco industries, which use subtle and creative messaging directed at youth, has been cited as one of the reasons that alcohol and tobacco are used at such high rates by adolescents and young adults, and it is feared that similar marketing strategies would contribute to increased rates of use and dependence by adolescents.<sup>78</sup> More importantly, opponents argue that despite earlier reports claiming that

marijuana has fewer long-term effects than either tobacco or alcohol, there are newer data on the medical and psychological effects of cannabis on adolescents, particularly younger teens. Research continues to accumulate on its potential negative effects on brain development and cognitive effects on short-term memory and learning.<sup>79,80</sup> Physical effects on coordination and reaction time raise serious concerns about the contribution of marijuana intoxication to motor vehicle injuries and deaths.<sup>81,82</sup> Medical consequences include respiratory effects<sup>83</sup> and the long-term effects of exposure to carcinogenic components of marijuana smoke, with a recent study from New Zealand finding elevated rates of lung cancer in adults with histories of long-term marijuana smoking.<sup>84</sup> Studies have also shown connections between chronic marijuana use and mental health disorders such as anxiety and schizophrenia.<sup>85</sup>

Ultimately, marijuana’s health and behavioral risks when used by either youth or adults may be irrelevant in terms of the criteria with which marijuana policy should be evaluated. Rather, the most salient criterion for evaluating these policies should be the determination of which policy (criminalization, decriminalization, or legalization) is most effective in minimizing harm.<sup>86</sup> One main argument against legalization but in support of decriminalization is that illicit substance use, including marijuana use, should be considered a public health problem, not something that should be given the “green light,” as would be the case if widespread legalization of marijuana and other substances occurred. This is an acknowledgment of the seriousness of issues related to substance use disorders for individuals and society, recognizing that problems related to use and small-scale possession, in contrast to those associated with large-scale production and trafficking, are best



dealt with in the public health and medical system, not the criminal justice system. This argument represents the commonly observed tension between a public health system's role in prevention, rehabilitation, and treatment compared with the criminal justice system's primary role of removing criminals from society (incarceration) and punishing them.

The amount of resources used by the criminal justice system to arrest, process, adjudicate through courts, and imprison people for minor drug-related charges (separate from more severe crimes, such as selling and trafficking) are significant, and many have cited potential cost savings as a reason for changing policies on individual use and possession.

### **Decriminalization**

Specific arguments for decriminalization are similar to those for legalization but also focus on the costs (both human and monetary) that are involved in the enforcement of criminal laws for what are considered either minor infractions or offenses that indicate a person's need for drug treatment. Data are abundant on the costs involved in the arrest, detention, court proceedings, and the imprisonment of youth and adults who have committed the offense of possessing small amounts of marijuana, which in 2006 cost state and local governments \$10.3 billion.<sup>87</sup> What is often not discussed are the long-term effects that adjudication or imprisonment for a marijuana offense can have for an individual and the subsequent effect that this can have on an individual's family and on society.<sup>88</sup>

### **POSSIBLE EFFECTS OF LEGALIZATION AND DECRIMINALIZATION OF MARIJUANA ON ADOLESCENTS**

#### **US Experience With Decriminalization**

Since a number of states have decriminalized marijuana, there has been close scrutiny to determine

whether this change would result in higher use rates among adolescents, in particular. Several studies have compared the rates in the initial 11 states that decriminalized marijuana in the 1970s before and after criminal laws were changed. None of these studies have supported the concern that rates would increase sharply in states with decriminalization. In fact, these studies, published in the early 1980s, found that the overall national declines in rates of use of alcohol and illicit substances, including marijuana, seen since the 1970s were similar in states with and without decriminalization laws.<sup>89-91</sup> Single,<sup>89</sup> one of the authors of these initial studies, provided an update of this issue in 1989 and found that although states with penalties for possession limited to fines experienced increased rates of marijuana use, these increases were similar to or lower than those observed in states that retained stiff penalties. They also concluded that states with decriminalization laws experienced significant savings in criminal justice costs and resources.

#### **International Experiences With Decriminalization**

In calling for a more humane approach to the problems of drug use and to address the concerns of opponents who believe that decriminalization will result in widespread increases in marijuana and other illicit substance use, people have also looked to the international experience of drug policy reform. In the case of Portugal, it has been demonstrated that in the 5 to 10 years since their laws were passed decriminalizing all drug use and possession, twice as many people have sought treatment for addiction than did so before the decriminalization of all illicit drugs in 2001. And although marijuana use rates were not higher than in countries that have stiff penalties, such as Norway and the United States, it is important to note that

reported rates of use among youth in Portugal did increase during that time.<sup>92</sup> Since 2001, Portugal has also experienced decreased rates of HIV infection from injection drug use, although rates of heroin use and some drug-related crimes have increased in some locales throughout the country.<sup>58</sup>

Although it is difficult to make cross-national comparisons, given differences in culture, legal statutes, and methods of data collection, in the Netherlands there has been an overall decline in the rates of current use since the 1970s, paralleling what has been observed across the European Union. Specifically, the current use rate among Dutch youth ages 15 to 24 is currently around 11%; this is higher than the 8.4% average use rate of other European Union nations, perhaps because of the liberal approach to marijuana selling and use in the Netherlands.<sup>93</sup> Both of these rates are significantly lower than rates reported in the United States.<sup>42</sup>

### **COMPARISONS BETWEEN MARIJUANA, ALCOHOL, AND TOBACCO**

One argument in support of marijuana legalization is that alcohol and tobacco cause more harm to society, in terms of financial and health costs, than marijuana.<sup>94</sup> This argument is based on their belief that tight controls on the use, possession, and sale of what some consider a benign substance, such as marijuana, are inconsistent with policies that permit the legal use of substances such as alcohol and tobacco, which cause far more harm to individuals and society. Few would argue that the use of tobacco and underage or excessive use of alcohol are not harmful. However, the harmful effects of marijuana are rarely included in discussions about legalization of recreational and medical marijuana use, despite the emerging and convincing data on the neurodevelopmental consequences of marijuana and its potential for

addiction. Proponents of legalization also claim that legalization would facilitate tighter control of its use through regulation, such as requiring a license for selling, restricting sale to those 21 years of age or older, and taxation, similar to what is done for alcohol and tobacco.<sup>94</sup> However, the lax enforcement of such laws for alcohol and tobacco and the push of advertisers to market these products to adolescents, despite legal sanctions, both suggest that it will be difficult to enforce similar limits of legal sale and advertising of marijuana to youth.<sup>78</sup> Rather than legalizing marijuana, given data supporting a causal relationship between tobacco advertising and promotional activities, and subsequent initiation and use of tobacco by youth, it has been suggested that tighter regulations and stricter enforcement of laws regulating advertisement and sales of tobacco and alcohol to minors are needed.<sup>95</sup>

The high current use rates of underage alcohol and tobacco among 12- to 17-year-olds (12.9% and 8.6%, respectively),<sup>42</sup> despite state laws barring the sale of alcohol to those younger than 21 years and tobacco usually to those younger than 18 years, support this concern. An additional concern is that over the past decade, adolescents' perception of the risks of heavy drinking, tobacco use, and marijuana use have declined, with significantly fewer youth now reporting that there is "great risk" associated with routine or heavy use of these substances.<sup>1</sup> Researchers cite these changes in perception of risk as contributors to this reversal of rates among youth. These perceptions have changed despite the emergence of societal norms opposing tobacco use in public and media coverage about excessive alcohol use and driving.<sup>96</sup>

## **SOCIETY AND SOCIAL JUSTICE**

The majority of arrests for marijuana possession occur among adolescents

and young adults; these arrests disproportionately affect young men and boys, particularly young black men and boys. Ongoing criminal prosecution for marijuana possession has led to serious and often permanent legal problems for these youth. Since 1991, marijuana arrests have nearly doubled,<sup>87</sup> but levels of marijuana use have not declined to a similar extent.<sup>1</sup> In 2009, there were 858 408 arrests for marijuana, of which 755 399 were for possession (88% of the total). Fifty-two percent of all marijuana possession arrests were in adolescents and young adults: Male adolescents ages 15 to 19 years accounted for 28% of all possession arrests, and young men ages 20 to 24 years accounted for another 24%. Thus approximately 392 807 adolescents and young adults were arrested for marijuana possession in 2009.<sup>97</sup> Although black people account for 13% of the population and only 15% of current marijuana users, since 2007 they have also consistently accounted for between 31% and 34% of marijuana possession arrests, reflecting the disparities in enforcement of prevailing laws across racial and ethnic groups throughout the United States.<sup>97–99</sup> Although no national data are available about the amount of marijuana that adolescents have in their possession at the time of arrest, the Federal Bureau of Investigation Uniform Crime Reports database revealed that, for example, in Massachusetts before decriminalization, 90% of arrests were for 1 ounce or less, and in Connecticut, 75% of arrests in those older than 18 years were for a half ounce or less.<sup>100,101</sup> After decriminalization of marijuana possession went into effect in Massachusetts in 2008, the number of minors arrested for marijuana possession dropped by 89%–90%—to 189 in 2009 and 170 in 2010.

Data are not available on the percentages of youth who are arrested for marijuana possession

who then have their charges dismissed, are charged with misdemeanors and petty offenses, have some kind of felony drug conviction, or are imprisoned. These numbers vary from state to state. Many people are held at least for some time in jail before they are charged with a crime. This can be a very traumatic and dangerous experience and could result in lost jobs and derailed education. Being released from jail can also be dangerous, because many jails release nonminors in the middle of the night, often without their possessions.<sup>102,103</sup> Currently, criminal prosecution for marijuana possession by teenagers and young adults adversely affects almost 400 000 youth a year in the United States.<sup>87</sup> Imprisonment represents direct removal of a person from needed roles in society: adults away from jobs, parents from young children, and adolescents from school and their families. Furthermore, these people are placed in environments where they are likely to have close contact with people who have committed serious violent offenses or are repeat offenders.

Advocates of decriminalization cite the importance, particularly for youth, of ensuring that criminal offenses are limited to misdemeanors or petty offenses or noncriminal civil violations. These reduced violations do not carry the requirement for short-term prison time or probation or the longer-term stigma of a felony drug conviction, which may result in the inability to obtain student loans or attend school, ineligibility for certain housing, and difficulties with future employment.<sup>104</sup> For example, students applying to college may be denied federal financial aid because of a drug conviction, including marijuana possession (part of the Higher Education Act Aid Elimination Penalty passed by Congress in 1998). Penalties for marijuana possession of 1 ounce or less range widely from state to state, with maximum

penalties ranging from a fine of only \$100 to \$5000 and 5 years in prison. Possession of greater than 1 ounce of marijuana usually results in larger maximum fines and jail time. As with any other law, penalties for marijuana possession should not be targeted at or applied disproportionately to minority populations.

Detention facilities are also ill-equipped to deal with issues that may relate to an inmate's substance use disorder, and many adolescents do not receive any treatment.<sup>105</sup> Few treatment programs are available as an alternative to incarceration. Treatment and diversion programs for drug use are not a usual focus of the criminal justice system, although some jurisdictions require drug education or community service for minors convicted of drug possession. Juvenile drug courts have also been used for drug education and treatment of minors convicted of drug possession.<sup>105</sup>

The main argument against decriminalization is that it will lead to increased rates of marijuana use and illicit substances in general, which in turn would lead to increases in criminal activity related to sales and distribution. It has also been argued that adolescents are frequent buyers of small amounts of marijuana, which leads to higher numbers of local drug dealers and more frequent interactions with them. Nearly 16% of 12- to 17-year-olds who bought marijuana did so from someone they had just met or did not know.<sup>106</sup> Anecdotally, some illicit drug dealers promote and sell numerous drugs simultaneously, such as cocaine and methamphetamine. Thus, adolescent buyers using the black market are potentially exposed to and encouraged to buy and try other psychoactive substances. Opponents also argue that it sends the "wrong message" to young people when the penalties for use are reduced to minor infractions that may carry little incentive to change behaviors.

Driving while intoxicated by marijuana may need a different policy approach. Cannabis is the most prevalent illicit drug detected in fatally injured drivers and motor vehicle crash victims.<sup>107</sup> However, currently there are no accepted lower levels of blood concentration for carboxy-THC, the active metabolite measured in serum, or standards regarding serum thresholds indicating intoxication.<sup>81</sup> Because carboxy-THC is lipid soluble, a positive serum level can be detected several weeks after abstinence in the chronic user.<sup>81</sup> Individual drivers can vary widely in their sensitivity for THC-induced impairment, as evinced by weak correlations between THC in serum and magnitude of performance impairment.<sup>81</sup> Plasma of drivers showing substantial impairment contained both high and low THC concentrations, and different drivers with high plasma concentrations showed substantial impairment, no impairment, and even some improvement.<sup>108,109</sup> Other THC metabolites are being investigated to help distinguish between acute and more chronic or heavy use.<sup>110</sup> Although blood alcohol content can be accurately measured and correlated with behavioral impairment, this may not be the case with cannabis, in part because alcohol is water soluble, whereas cannabis is stored in the fat and is metabolized differently, making a direct correlation with behavior difficult to measure.<sup>109</sup> Because marijuana use does cause impaired driving, pediatricians should explicitly counsel adolescents to never drive under the influence of marijuana.

#### **SUMMARY**

Marijuana use in pediatric populations remains an ongoing concern, and marijuana use by adolescents has known medical, psychological, and cognitive side effects. Marijuana alters brain development, with detrimental effects on brain structure and function, in

ways that are incompletely understood. Furthermore, marijuana smoke contains tar and other harmful chemicals, so it cannot be recommended by physicians. At this time, there is no published research to suggest benefit of marijuana use by children and adolescents. In the context of limited but clear evidence showing harm or potential harm from marijuana use by adolescents, formal recommendations for "medical marijuana" use by adolescents are contrary to current evidence. Exceptions may be those that pertain to emerging anecdotal information concerning the medical potential of cannabinoid medications, which may be an option for children who have life-limiting or severely debilitating conditions and for whom current therapies are inadequate. Criminal prosecution for marijuana possession adversely affects hundreds of thousands of youth yearly in the United States, particularly minority youth. Current evidence does not support a focus on punishment for youth who use marijuana. Rather, drug education and treatment programs should be encouraged to better help youth who are experimenting with or dependent on marijuana. Decriminalization of recreational use of marijuana by adults has also not led to an increase in youth use rates of recreational marijuana. Thus, decriminalizing simple possession of marijuana for both minors and young adults may be a reasonable alternative to outright criminal prosecution, as long as it is coupled with drug education and treatment programs. The impact of outright legalization of adult recreational use of marijuana on youth use is unknown, and it cannot be recommended.

At this time, evaluative data on the impact of recently enacted laws regulating and taxing marijuana for adults in Washington State and Colorado may inform the issue of how youth are affected. At a minimum, marijuana should be regulated

closely, similar to what has been attempted for tobacco products and alcohol, in terms of restrictions on marketing and sale to those younger than 21 years old, continued penalties for the wholesale distribution of marijuana, clean indoor air acts to protect against passive marijuana smoke, and bans on marijuana use on college campuses, schools, and child care centers. However, the AAP recognizes that despite ongoing regulation of the tobacco and alcohol industries, youth remain common targets and ultimately consumers of these products. Thus, more effective regulation of the medical marijuana and legal marijuana industries is crucial to truly protect children and adolescents from potential harm.

#### **APPENDIX. STATISTICAL SIGNIFICANCE OF THE INCREASE OR DECREASE OF CURRENT TEEN USE OF MARIJUANA BEFORE AND AFTER PASSAGE OF A MEDICAL MARIJUANA LAW**

The Youth Risk Behavior Survey (YRBS) provides an online tool to access the statistical significance of changes in the variable data they collect. Below is specific information detailing the *P* value of the increase or decrease in current marijuana use rates for 12th graders in the years immediately preceding passage of a state medical marijuana law compared with the most recent year for which there are data. To access the full information with tables on the YRBS Web site, visit <http://nccd.cdc.gov/YouthOnline/App/QuestionsOrLocations.aspx?CategoryId=C3>.

This application allows only running the statistical significance for states in which YRBS collected data, which is not applicable to California, Oregon, and Washington.

#### **Alaska**

In 1995, 30.9% of 12th graders in Alaska reported being current marijuana users (having used in the past month) on the YRBS. In 1998, the voters of Alaska passed their medical

marijuana law. In 2011, only 22.2% of 12th graders in Alaska reported being current marijuana users on the YRBS. The difference in use rates—8.7 percentage points—is statistically significant, with *P* = .03. In 2013, 22.4% of 12th graders were current users, a nonsignificant increase from 2011.

#### **Maine**

In 1997, 33.1% of 12th graders in Maine reported being current marijuana users (having used in the past month) on the YRBS. In 1999, the voters of Maine passed their medical marijuana law. In 2011, 27.3% of 12th graders in Maine reported being current marijuana users on the YRBS. The difference in use rates—5.8 percentage points—is not statistically significant, with *P* = .12. In 2013, 29.5% of 12th graders were current users, a nonsignificant increase from 2011.

#### **Hawaii**

In 1999, 27.2% of 12th graders in Hawaii reported being current marijuana users (having used in the past month) on the YRBS. In 2000, Hawaii passed its medical marijuana law via the legislature. In 2011, 25.4% of 12th graders in Hawaii reported being current marijuana users on the YRBS. The difference in use rates—1.8 percentage points—is not statistically significant, with *P* = .67. In 2013, 22.9% of 12th graders were current users, a nonsignificant decrease from 2011.

#### **Nevada**

In 1999, 27.5% of 12th graders in Nevada reported being current marijuana users (having used in the past month) on the YRBS. In 2001, Nevada passed its medical marijuana law via the legislature. In 2009, only 22.7% of 12th graders in Nevada reported being current marijuana users on the YRBS. The difference in use rates—4.8 percentage points—is not statistically significant, *P* = .34. In 2013, 21.5% of 12th graders were current users, a nonsignificant decrease from 2009.

#### **Montana**

In 2003, 29.1% of 12th graders in Montana reported being current marijuana users (having used in the past month) on the YRBS. In 2004, the voters of Montana passed their medical marijuana law. In 2011, 27.2% of 12th graders in Montana reported being current marijuana users on the YRBS. The difference in use rates—1.9 percentage points—is not statistically significant, with *P* = .63. In 2013, 24.0% of 12th graders were current users, a nonsignificant decrease from 2011.

#### **Vermont**

In 2003, 37.2% of 12th graders in Vermont reported being current marijuana users (having used in the past month) on the YRBS. In 2004, Vermont passed its medical marijuana law via the legislature. In 2011, 31.5% of 12th graders in Vermont reported being current marijuana users on the YRBS. The difference in use rates—5.7 percentage points—is not statistically significant, with *P* = .07. In 2013, 32.8% of 12th graders were current users, a nonsignificant increase from 2011.

#### **Rhode Island**

In 2005, 34.3% of 12th graders in Rhode Island reported being current marijuana users (having used in the past month) on the YRBS. In 2006, Rhode Island passed its medical marijuana law via the legislature. In 2011, 34.0% of 12th graders in Rhode Island reported being current marijuana users on the YRBS. The difference in use rates—0.3 percentage points—is not statistically significant, with *P* = .93. In 2013, 37.0% of 12th graders were current users, a nonsignificant increase from 2011.

#### **New Mexico**

In 2007, 25.4% of 12th graders in New Mexico reported being current marijuana users (having used in the past month) on the YRBS. In mid-

2007, New Mexico passed its medical marijuana law via the legislature. In 2011, 26.8% of 12th graders in New Mexico reported being current marijuana users on the YRBS. The difference in use rates—1.4 percentage points—is not statistically significant, with  $P = .66$ . In 2013, 32.7% of 12th graders were current users, a significant increase from 2011.

### Michigan

In 2007, 19.0% of 12th graders in Michigan reported being current marijuana users (having used in the past month) on the YRBS. In 2008, Michigan voters passed their medical marijuana law. In 2011, 21.1% of 12th graders in Michigan reported being current marijuana users on the YRBS. The difference in use rates—2.1 percentage points—is not statistically significant, with  $P = .57$ . In 2013, 24.7% of 12th graders were current users, a nonsignificant increase from 2011.

### Arizona

In 2009, 28.2% of 12th graders in Arizona reported being current marijuana users (having used in the past month) on the YRBS. In 2010, Arizona voters passed their medical marijuana law. In 2011, 27.1% of 12th graders in Arizona reported being current marijuana users on the YRBS. The difference in use rates—1.1 percentage points—is not statistically significant, with  $P = .74$ . In 2013, 25.4% of 12th graders were current users, a nonsignificant decrease from 2011.

### New Jersey

In 2009, 31.0% of 12th graders in New Jersey reported being current marijuana users (having used in the past month), on the YRBS. In 2010, New Jersey voters passed their medical marijuana law. In 2011, 33.4% of 12th graders in New Jersey reported being current marijuana users on the YRBS. The difference in use rates—2.4 percentage points—is not statistically significant, with  $P = .74$ . In 2013, 29.7% of 12th graders

were current users, a nonsignificant decrease from 2011.

### LEAD AUTHORS

Seth D. Ammerman, MD, FAAP  
Sheryl A. Ryan, MD, FAAP  
\*William P. Adelman MD, FAAP

### COMMITTEE ON SUBSTANCE ABUSE, 2014–2015

Sharon Levy, MD, MPH, FAAP, Chairperson  
Seth D. Ammerman, MD, FAAP  
Pamela K. Gonzalez, MD, FAAP  
Sheryl A. Ryan, MD, FAAP  
Lorena M. Siqueira, MD, MSPH, FAAP  
Vincent C. Smith, MD, MPH, FAAP

### LIAISONS

Vivian B. Faden, PhD – *National Institute of Alcohol Abuse and Alcoholism*  
Gregory Tau, MD, PhD – *American Academy of Child and Adolescent Psychiatry*

### STAFF

James Baumberger, MPP  
Katie Crumley, MPP  
Renee Jarrett, MPH

### COMMITTEE ON ADOLESCENCE, 2014–2015

Paula K. Braverman, MD, FAAP, Chairperson  
\*William P. Adelman, MD, FAAP  
Elizabeth Meller Alderman, MD, FSAHM, FAAP  
Cora C. Breuner, MD, MPH, FAAP  
David A. Levine, MD, FAAP  
Arik V. Marcell, MD, FAAP  
Rebecca Flynn O'Brien, MD, FAAP

### LIAISONS

Margo Lane, MD, FRCPC – *Canadian Pediatric Society*  
Benjamin Shain, MD, PhD – *American Academy of Child and Adolescent Psychiatry*  
Julie Strickland, MD – *American College of Obstetricians and Gynecologists*  
Lauren B. Zapata, MD, PhD, MSPH – *Centers for Disease Control and Prevention*

### STAFF

James Baumberger, MPP  
Karen S. Smith

\*The views expressed are those of the author and do not necessarily reflect the policy or position of the Department of the Army, Department of Defense, or the US Government.

### RESOURCES

American Academy of Pediatrics:  
[www.aap.org/marijuana](http://www.aap.org/marijuana)  
National Institute on Drug Abuse:  
[www.drugabuse.gov](http://www.drugabuse.gov)  
Office of National Drug Control Policy:  
[www.whitehouse.gov/ondcp](http://www.whitehouse.gov/ondcp)

Smart Approaches to Marijuana:  
<http://learnaboutsam.com>  
Substance Abuse and Mental Health Services Administration:  
[www.samhsa.gov](http://www.samhsa.gov)  
US Department of Health & Human Services, Office of Adolescent Health:  
[www.hhs.gov/ash/oah/resources-and-publications/publications/substance-abuse.html](http://www.hhs.gov/ash/oah/resources-and-publications/publications/substance-abuse.html)

### REFERENCES

1. Johnston LD, O'Malley PM, Miech RA, Bachman JG, Schulenberg JE. *Monitoring the Future National Survey on Drug Use 1975–2013. 2013 Overview: Key Findings on Adolescent Drug Use*. Ann Arbor, MI: University of Michigan, Institute for Social Research; 2014. Available at: [www.monitoringthefuture.org/pubs/monographs/mtf-overview2013.pdf](http://www.monitoringthefuture.org/pubs/monographs/mtf-overview2013.pdf). Accessed December 14, 2014
2. Eaton DK, Kann L, Kinchen S, et al; Centers for Disease Control and Prevention (CDC). Youth risk behavior surveillance – United States, 2011. *MMWR Surveill Summ*. 2012;61(4): 1–162. Available at: [www.cdc.gov/mmwr/pdf/ss/ss6304.pdf](http://www.cdc.gov/mmwr/pdf/ss/ss6304.pdf). Accessed December 14, 2014
3. National Survey on Drug Use and Health. Population data: NSDUH. Available at: [www.samhsa.gov/data/population-data-nsduh/reports](http://www.samhsa.gov/data/population-data-nsduh/reports). Accessed December 14, 2014
4. MetLife Foundation. 2012 Partnership Attitude Tracking Study: Parents and Teens. Full Report. New York, NY: MetLife Foundation; 2012. Available at: [www.drugfree.org/wp-content/uploads/2013/04/PATS-2012-FULL-REPORT2.pdf](http://www.drugfree.org/wp-content/uploads/2013/04/PATS-2012-FULL-REPORT2.pdf). Accessed December 14, 2014
5. Substance Abuse and Mental Health Services Administration. National Survey on Drug Use and Health: summary of NSDUH. Available at: <http://oas.samhsa.gov/NSDUH/2k10NSDUH/2k10Results.htm#1.1>. Accessed June 3, 2014
6. Choo EK, Benz M, Zaller N, Warren O, Rising KL, McConnell KJ. The impact of state medical marijuana legislation on adolescent marijuana use. *J Adolesc Health*. 2014;55(2):160–166. doi:10.1016/j.jadohealth.2014.02.018
7. Lynne-Landsman SD, Livingston MD, Wagenaar AC. Effects of state medical marijuana laws on adolescent

- marijuana use. *Am J Public Health*. 2013;103(8):1500–1506
8. Holland J, ed. *The Pot Book. A Complete Guide to Cannabis: Its Role in Medicine, Politics, Science, and Culture*. South Paris, ME: Park Street Press; 2010
  9. Wang T, Collet JP, Shapiro S, Ware MA. Adverse effects of medical cannabinoids: a systematic review. *CMAJ*. 2008;178(13):1669–1678
  10. Wolff V, Lauer V, Rouyer O, et al. Cannabis use, ischemic stroke, and multifocal intracranial vasoconstriction: a prospective study in 48 consecutive young patients. *Stroke*. 2011;42(6):1778–1780
  11. Appelboom A, Oades PJ. Coma due to cannabis toxicity in an infant. *Eur J Emerg Med*. 2006;13(3):177–179
  12. Wang GS, Roosevelt G, Heard K. Pediatric marijuana exposures in a medical marijuana state. *JAMA Pediatr*. 2013;167(7):630–633
  13. Yakovlev PI, Lecours AR. The myelogenetic cycles of regional maturation of the brain. In: Minkowski A, ed. *Regional Development of the Brain in Early Life*. Boston, MA: Blackwell Scientific; 1967:3–70
  14. Sowell ER, Thompson PM, Leonard CM, Welcome SE, Kan E, Toga AW. Longitudinal mapping of cortical thickness and brain growth in normal children. *J Neurosci*. 2004;24(38):8223–8231
  15. Giedd JN. Structural magnetic resonance imaging of the adolescent brain. *Ann N Y Acad Sci*. 2004;1021:77–85
  16. Sowell ER, Thompson PM, Holmes CJ, Jernigan TL, Toga AW. In vivo evidence for post-adolescent brain maturation in frontal and striatal regions. *Nat Neurosci*. 1999;2(10):859–861
  17. Hüppi PS, Dubois J. Diffusion tensor imaging of brain development. *Semin Fetal Neonatal Med*. 2006;11(6):489–497
  18. Gogtay N, Giedd JN, Lusk L, et al. Dynamic mapping of human cortical development during childhood through early adulthood. *Proc Natl Acad Sci USA*. 2004;101(21):8174–8179
  19. Luna B, Sweeney JA. The emergence of collaborative brain function: FMRI studies of the development of response inhibition. *Ann N Y Acad Sci*. 2004;1021:296–309
  20. Schepis TS, Adinoff B, Rao U. Neurobiological processes in adolescent addictive disorders. *Am J Addict*. 2008;17(1):6–23
  21. Casey BJ, Getz S, Galvan A. The adolescent brain. *Dev Rev*. 2008;28(1):62–77
  22. Winters KC, Lee CY. Likelihood of developing an alcohol and cannabis use disorder during youth: association with recent use and age. *Drug Alcohol Depend*. 2008;92(1–3):239–247
  23. Casey BJ, Jones RM. Neurobiology of the adolescent brain and behavior: implications for substance use disorders. *J Am Acad Child Adolesc Psychiatry*. 2010;49(12):1189–1201, quiz 1285
  24. Perkonig A, Goodwin RD, Fiedler A, et al. The natural course of cannabis use, abuse and dependence during the first decades of life. *Addiction*. 2008;103(3):439–449, discussion 450–451
  25. von Sydow K, Lieb R, Pfister H, Höfler M, Sonntag H, Wittchen HU. The natural course of cannabis use, abuse and dependence over four years: a longitudinal community study of adolescents and young adults. *Drug Alcohol Depend*. 2001;64(3):347–361
  26. Medina KL, Hanson KL, Schweinsburg AD, Cohen-Zion M, Nagel BJ, Tapert SF. Neuropsychological functioning in adolescent marijuana users: subtle deficits detectable after a month of abstinence. *J Int Neuropsychol Soc*. 2007;13(5):807–820
  27. Gonzalez R, Swanson JM. Long-term effects of adolescent-onset and persistent use of cannabis. *Proc Natl Acad Sci USA*. 2012;109(40):15970–15971
  28. Medina KL, Schweinsburg AD, Cohen-Zion M, Nagel BJ, Tapert SF. Effects of alcohol and combined marijuana and alcohol use during adolescence on hippocampal volume and asymmetry. *Neurotoxicol Teratol*. 2007;29(1):141–152
  29. Nagel BJ, Schweinsburg AD, Phan V, Tapert SF. Reduced hippocampal volume among adolescents with alcohol use disorders without psychiatric comorbidity. *Psychiatry Res*. 2005;139(3):181–190
  30. Medina KL, McQueeney T, Nagel BJ, Hanson KL, Schweinsburg AD, Tapert SF. Prefrontal cortex volumes in adolescents with alcohol use disorders: unique gender effects. *Alcohol Clin Exp Res*. 2008;32(3):386–394
  31. Schweinsburg AD, Nagel BJ, Schweinsburg BC, Park A, Theilmann RJ, Tapert SF. Abstinent adolescent marijuana users show altered fMRI response during spatial working memory. *Psychiatry Res*. 2008;163(1):40–51
  32. Squeglia LM, Jacobus J, Tapert SF. The influence of substance use on adolescent brain development. *Clin EEG Neurosci*. 2009;40(1):31–38
  33. Silins E, Horwood LJ, Patton GC, et al. Young adult sequelae of adolescent cannabis use: an integrative analysis. *Lancet Psychiatry*. 2014;1(4):286–293
  34. Volkow ND, Baler RD, Compton WM, Weiss SRB. Adverse health effects of marijuana use. *N Engl J Med*. 2014;370(23):2219–2227
  35. Navari RM. Antiemetic control: toward a new standard of care for emetogenic chemotherapy. *Expert Opin Pharmacother*. 2009;10(4):629–644
  36. Pooyania S, Ethans K, Szturm T, Casey A, Perry D. A randomized, double-blinded, crossover pilot study assessing the effect of nabilone on spasticity in persons with spinal cord injury. *Arch Phys Med Rehabil*. 2010;91(5):703–707
  37. Sastre-Garriga J, Vila C, Glissold S, Montalban X. THC and CBD oromucosal spray (Sativex®) in the management of spasticity associated with multiple sclerosis. *Expert Rev Neurother*. 2011;11(5):627–637
  38. Marijuana Policy Project. *The Twenty Three States and One Federal District With Effective Medical Marijuana Laws*. Washington, DC: Marijuana Policy Project; April 2014. Available at: [www.mpp.org/assets/pdfs/library/MMJLawsSummary.pdf](http://www.mpp.org/assets/pdfs/library/MMJLawsSummary.pdf). Accessed December 14, 2014
  39. Hazekamp A, Ruhaak R, Zuurman L, van Gerven J, Verpoorte R. Evaluation of a vaporizing device (Volcano) for the pulmonary administration of tetrahydrocannabinol. *J Pharm Sci*. 2006;95(6):1308–1317
  40. Abrams DI, Vizoso HP, Shade SB, Jay C, Kelly ME, Benowitz NL. Vaporization as a smokeless cannabis delivery system:

- a pilot study. *Clin Pharmacol Ther*. 2007; 82(5):572–578
41. Fishedick J, Van Der Kooy F, Verpoorte R. Cannabinoid receptor 1 binding activity and quantitative analysis of *Cannabis sativa* L. smoke and vapor. *Chem Pharm Bull (Tokyo)*. 2010;58(2):201–207
  42. US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration. Results from the 2012 National Survey on Drug Use and Health: summary of national findings. Available at: [www.samhsa.gov/data/NSDUH/2012SummNatFindDetTables/NationalFindings/NSDUHresults2012.htm#lot](http://www.samhsa.gov/data/NSDUH/2012SummNatFindDetTables/NationalFindings/NSDUHresults2012.htm#lot). Accessed December 14, 2014
  43. Wall MM, Poh E, Cerdá M, Keyes KM, Galea S, Hasin DS. Adolescent marijuana use from 2002 to 2008: higher in states with medical marijuana laws, cause still unclear. *Ann Epidemiol*. 2011;21(9):714–716
  44. Salomonsen-Sautel S, Sakai JT, Thurstone C, Corley R, Hopfer C. Medical marijuana use among adolescents in substance abuse treatment. *J Am Acad Child Adolesc Psychiatry*. 2012;51(7):694–702
  45. American College of Physicians. *Supporting Research Into the Therapeutic Role of Marijuana: Position Paper*. Philadelphia, PA: American College of Physicians; 2008. Available at: [www.acponline.org/advocacy/where\\_we\\_stand/other\\_issues/medmarijuana.pdf](http://www.acponline.org/advocacy/where_we_stand/other_issues/medmarijuana.pdf). Accessed December 14, 2014
  46. California Society of Addiction Medicine. *CSAM Statement on the Medical Aspects of Marijuana Legalization*. San Francisco, CA: California Society of Addiction Medicine; 2010. Available at: [www.csam-asam.org/pdf/misc/Legalization.pdf](http://www.csam-asam.org/pdf/misc/Legalization.pdf). Accessed December 14, 2014
  47. Aggarwal SK, Carter GT, Sullivan MD, ZumBrunnen C, Morrill R, Mayer JD. Medicinal use of cannabis in the United States: historical perspectives, current trends, and future directions. *J Opioid Manag*. 2009;5(3):153–168
  48. Cotter J. Efficacy of crude marijuana and synthetic delta-9-tetrahydrocannabinol as treatment for chemotherapy-induced nausea and vomiting: a systematic literature review. *Oncol Nurs Forum*. 2009;36(3):345–352
  49. Scotter EL, Abood ME, Glass M. The endocannabinoid system as a target for the treatment of neurodegenerative disease. *Br J Pharmacol*. 2010;160(3):480–498
  50. Rahn EJ, Hohmann AG. Cannabinoids as pharmacotherapies for neuropathic pain: from the bench to the bedside. *Neurotherapeutics*. 2009;6(4):713–737
  51. Lynch ME, Campbell F. Cannabinoids for treatment of chronic non-cancer pain; a systematic review of randomized trials. *Br J Clin Pharmacol*. 2011;72(5):735–744. doi:10.1111/j.1365-2125.2011.03970
  52. Peat S. Using cannabinoids in pain and palliative care. *Int J Palliat Nurs*. 2010;16(10):481–485
  53. Penner EA, Buettner H, Mittleman MA. The impact of marijuana use on glucose, insulin, and insulin resistance among US adults. *Am J Med*. 2013;126(7):583–589
  54. Gerich ME, Isfort RW, Brimhall B, Siegel CA. Medical marijuana for digestive disorders: high time to prescribe? [published online ahead of print September 9, 2014]. *Am J Gastroenterol*. doi:10.1038/ajg.2014.245
  55. Koppel BS, Brust JCM, Fife T, et al. Systematic review: efficacy and safety of medical marijuana in selected neurologic disorders. Report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology*. 2014;82(17):1556–1563
  56. Haase HJ, Eyle NE, Schimpf JR. *The International Drug Control Treaties: How Important Are They to US Drug Reform?* New York, NY: New York City Bar Association, Committee on Drugs and the Law, Special Subcommittee on International Drug Law and Policy; 2012. Available at: <http://www2.nycbar.org/pdf/InternationalDrugControlTreatiesArticle.pdf>. Accessed December 14, 2014
  57. Castaldi M, Llambias F. Uruguay becomes first country to legalize marijuana trade. Reuters. December 10, 2013. Available at: [www.reuters.com/article/2013/12/11/us-uruguay-marijuana-vote-idUSBRE9BA01520131211](http://www.reuters.com/article/2013/12/11/us-uruguay-marijuana-vote-idUSBRE9BA01520131211). Accessed December 14, 2014
  58. Domoslawski A. *Drug Policy in Portugal: The Benefits of Decriminalizing Drug Use*. Warsaw, Poland: Open Society Foundations; 2011. Available at: [www.opensocietyfoundations.org/reports/drug-policy-portugal-benefits-decriminalizing-drug-use](http://www.opensocietyfoundations.org/reports/drug-policy-portugal-benefits-decriminalizing-drug-use). Accessed December 14, 2014
  59. Greenwald G. *Drug Decriminalization in Portugal: Lessons for Creating Fair and Successful Drug Policies*. Washington, DC: Cato Institute; 2009
  60. Vastag B. 5 years after: Portugal's drug decriminalization policy shows positive results. *Scientific American*. April 7, 2009. Available at: [www.scientificamerican.com/article/portugal-drug-decriminalization/](http://www.scientificamerican.com/article/portugal-drug-decriminalization/). Accessed December 14, 2014
  61. van der Gouwe D, Ehrlich E, van Laar MW. *Drug Policies in the Netherlands*. Utrecht, the Netherlands: Trimbos Instituut; March 2005. Available at: [www.trimbos.org/projects/research-monitoring-and-policies/drug-policy-in-the-netherlands](http://www.trimbos.org/projects/research-monitoring-and-policies/drug-policy-in-the-netherlands). Accessed December 14, 2014
  62. Trimbos Instituut. *Drug Situation 2006, The Netherlands by the Reitox National Focal Point: Report to the EMCDDA*. Utrecht, the Netherlands: Trimbos Instituut; 2007:18. Available at: [www.trimbos.org/~media/English%20site/AF1130%20The%20Netherlands%20Drug%20Situation%202011\\_web.aspx](http://www.trimbos.org/~media/English%20site/AF1130%20The%20Netherlands%20Drug%20Situation%202011_web.aspx). Accessed December 14, 2014
  63. MacCoun R, Reuter P. Interpreting Dutch cannabis policy: reasoning by analogy in the legalization debate. *Science*. 1997;278(5335):47–52
  64. Martin A. Amsterdam will ban tourists from pot coffee shops. *The Wire*. May 27, 2011. Available at: [www.theatlanticwire.com/global/2011/05/amsterdam-ban-pot-sales-tourists/38248](http://www.theatlanticwire.com/global/2011/05/amsterdam-ban-pot-sales-tourists/38248). Accessed December 14, 2014
  65. Waterfield B. Tourists exempted from ban on smoking cannabis in Amsterdam. *The Telegraph*. December 12, 2012. Available at: [www.telegraph.co.uk/news/worldnews/europe/netherlands/9740463/Tourists-exempted-from-ban-on-smoking-cannabis-in-Amsterdam.html](http://www.telegraph.co.uk/news/worldnews/europe/netherlands/9740463/Tourists-exempted-from-ban-on-smoking-cannabis-in-Amsterdam.html). Accessed December 14, 2014
  66. Holligan A. Dutch to re-classify high-strength cannabis. *BBC News Europe*. October 7, 2011. Available at: [www.bbc.com/news/world-europe-15225270](http://www.bbc.com/news/world-europe-15225270). Accessed December 14, 2014
  67. Shaffer Library of Drug Policy. Drug laws in South America. Available at: [www.druglibrary.org/Schaffer/library/](http://www.druglibrary.org/Schaffer/library/)

- southam1.htm. Accessed December 14, 2014
68. Transnational Institute. Drug law reform in Latin America. Brazil. Available at: [www.druglawreform.info/en/country-information/brazil/item/201-brazil](http://www.druglawreform.info/en/country-information/brazil/item/201-brazil). Accessed December 14, 2014
  69. Quilodran F. Chile Supreme Court OKs medical marijuana company. *Associated Press*. October 7, 2011. Available at: [www.boston.com/business/articles/2011/10/07/chile\\_supreme\\_court\\_oks\\_medical\\_marijuana\\_company/](http://www.boston.com/business/articles/2011/10/07/chile_supreme_court_oks_medical_marijuana_company/). Accessed December 14, 2014
  70. Connors W. Canada's new marijuana laws set stage for growth. *Wall Street Journal Market Watch*. April 17, 2014. Available at: [www.marketwatch.com/story/canadas-new-marijuana-laws-set-stage-for-growth-2014-04-17?pagenumber=2](http://www.marketwatch.com/story/canadas-new-marijuana-laws-set-stage-for-growth-2014-04-17?pagenumber=2). Accessed December 14, 2014
  71. Carney S. Czech govt allows 5 cannabis plants for personal use from 2010. *Wall Street Journal*. December 8, 2009. Available at: <http://blogs.wsj.com/emergingeuropa/2009/12/08/czech-govt-allows-5-cannabis-plants-for-personal-use-from-2010/>. Accessed December 14, 2014
  72. StoptheDrugWar.org. China celebrates UN anti-drug day with 59 executions. Available at: <http://stopthedrugwar.org/chronicle/192/chinakillings.shtml>. Accessed December 14, 2014
  73. Media Awareness Project. Saudi Arabia: Pakistani and Iraqi beheaded in Saudi Arabia. Available at: [www.mapinc.org/drugnews/v05.n006.a08.html](http://www.mapinc.org/drugnews/v05.n006.a08.html). Accessed December 14, 2014
  74. US Department of Justice, Drug Enforcement Administration, Office of Diversion Control. *Controlled Substances Security Manual*. Available at: [www.deadiversion.usdoj.gov/pubs/manuals/sec/app\\_law.htm](http://www.deadiversion.usdoj.gov/pubs/manuals/sec/app_law.htm). Accessed December 14, 2014
  75. National Organization for the Reform of Marijuana Laws. States that have decriminalized. Available at: <http://norml.org/aboutmarijuana/item/states-that-have-decriminalized>. Accessed December 14, 2014
  76. *Effective Arguments for Advocates of Taxing and Regulating Marijuana*. Washington, DC: Marijuana Policy Project; May 29, 2014. Available at: [www.mpp.org/assets/pdfs/library/Effective-Arguments-for-T-R.pdf](http://www.mpp.org/assets/pdfs/library/Effective-Arguments-for-T-R.pdf). Accessed December 14, 2014
  77. United Nations Office on Drugs and Crime. Data and analysis. Available at: [www.unodc.org/unodc/en/data-and-analysis/index.html?ref=menuse](http://www.unodc.org/unodc/en/data-and-analysis/index.html?ref=menuse). Accessed December 14, 2014
  78. Campaign for Tobacco Free Kids. Tobacco company marketing to kids. Available at: [www.tobaccofreekids.org/research/factsheets/pdf/0008.pdf](http://www.tobaccofreekids.org/research/factsheets/pdf/0008.pdf). Accessed December 14, 2014
  79. Schweinsburg AD, Brown SA, Tapert SF. The influence of marijuana use on neurocognitive functioning in adolescents. *Curr Drug Abuse Rev*. 2008;1(1):99–111
  80. Pope HG Jr, Gruber AJ, Hudson JI, Huestis MA, Yurgelun-Todd D. Neuropsychological performance in long-term cannabis users. *Arch Gen Psychiatry*. 2001;58(10):909–915
  81. Ramaekers JG, Berghaus G, van Laar MW, Drummer OH. Dose related risk of motor vehicle crashes after cannabis use: an update. In: Verster JC, Pandi-Perumal SR, Ramaekers JG, de Gier JJ, eds. *Drugs, Driving, and Traffic Safety*. Geneva, Switzerland: World Health Organization; 2009:477–499
  82. Neavyn MJ, Blohm E, Babu KM, Bird SB. Medical marijuana and driving: a review. *J Med Toxicol*. 2014;10(3):269–279 doi:10.1007/s13181-014-0393-4
  83. Joshi M, Joshi A, Bartter T. Marijuana and lung diseases. *Curr Opin Pulm Med*. 2014;20(2):173–179
  84. Aldington S, Harwood M, Cox B, et al; Cannabis and Respiratory Disease Research Group. Cannabis use and risk of lung cancer: a case-control study. *Eur Respir J*. 2008;31(2):280–286
  85. Moore TH, Zammit S, Lingford-Hughes A, et al. Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review. *Lancet*. 2007;370(9584):319–328
  86. Hall W. The adverse health effects of cannabis use: what are they, and what are their implications for policy? *Int J Drug Policy*. 2009;20(6):458–466
  87. Gettman J. Marijuana arrests in the United States: 1991–2009. Executive summary. *Bulletin of Cannabis Reform*. November 2009;7. Available at: [www.drugscience.org/bcr/](http://www.drugscience.org/bcr/). Accessed December 14, 2014
  88. Johnston LD, Bachman JG, O'Malley PM. *Marijuana Decriminalization: The Impact on Youth, 1975–1980*. Occasional Paper 13. Ann Arbor, MI: University of Michigan, Institute for Social Research; 1981
  89. Single EW. The impact of marijuana decriminalization. In: Israel Y, Glaser FB, Kalant H, Popham RE, Schmidt W, Smart RG, eds. *Research Advances in Alcohol and Drug Problems*. Vol 6. New York, NY: Plenum; 1981:405–424
  90. Maloff DR. A review of the effects of the decriminalization of marijuana. *Contemp Drug Probl*. 1981;10(3):307–322
  91. Single EW. The impact of marijuana decriminalization: an update. *J Public Health Policy*. 1989;10(4):456–466
  92. Greenwald G. *Drug Decriminalization in Portugal: Lessons for Creating Fair and Successful Drug Policies*. Washington, DC: Cato Institute; 2009
  93. European Monitoring Centre for Drugs and Drug Addiction. Cannabis. Prevalence and patterns of use. Available at: [www.emcdda.europa.eu/online/annual-report/2010/cannabis/3](http://www.emcdda.europa.eu/online/annual-report/2010/cannabis/3). Accessed December 14, 2014
  94. Marijuana Policy Project. *Top Ten Reasons to End Marijuana Prohibition by Taxing and Regulation Marijuana*. Available at: [www.mpp.org/assets/pdfs/library/Top-Ten-Reasons.pdf](http://www.mpp.org/assets/pdfs/library/Top-Ten-Reasons.pdf). Accessed December 16, 2014
  95. Biener L, Siegel M. Tobacco marketing and adolescent smoking: more support for a causal inference. *Am J Public Health*. 2000;90(3):407–411
  96. Perkins HW, Linkenbach JW, Lewis MA, Neighbors C. Effectiveness of social norms media marketing in reducing drinking and driving: a statewide campaign. *Addict Behav*. 2010;35(10):866–874
  97. The Marijuana Policy Almanac: marijuana arrests in the United States. *Bulletin of Cannabis Reform*. Available at: [www.drugscience.org/States/US\\_US\\_home.htm](http://www.drugscience.org/States/US_US_home.htm). Accessed December 14, 2014
  98. US Census Bureau. State & county quickfacts. 2014. Available at: <http://www.census.gov/quickfacts/>



- quickfacts.census.gov/qfd/states/00000.html. Accessed December 14, 2014
99. Substance Abuse and Mental Health Services Administration. Table 1.24A: marijuana use in lifetime, past year, past month among persons aged 12 or older, by demographic characteristics. 2012. Available at: [www.samhsa.gov/data/NSDUH/2012SummNatFindDetTables/DetTabs/NSDUH-DetTabsSect1peTabs1to46-2012.htm#Tab1.24A](http://www.samhsa.gov/data/NSDUH/2012SummNatFindDetTables/DetTabs/NSDUH-DetTabsSect1peTabs1to46-2012.htm#Tab1.24A). Accessed December 14, 2014
100. Federal Bureau of Investigation. Uniform crime reports. Accessed by e-mail communication, June 27, 2014
101. State of Connecticut, Office of Fiscal Analysis. An Act Concerning the Penalty for Certain Nonviolent Drug Offenses [sSB-1014]. Available at: [www.cga.ct.gov/2011/FN/2011SB-01014-R01-FN.htm](http://www.cga.ct.gov/2011/FN/2011SB-01014-R01-FN.htm). Accessed December 14, 2014
102. Cacik A. Shedding light on late-night jail releases. *Mission & State*. February 7, 2014. Available at: [www.missionandstate.org/blog/shedding-light-late-night-jail-releases/](http://www.missionandstate.org/blog/shedding-light-late-night-jail-releases/). Accessed December 14, 2014
103. Grissom B. Out of jail and onto the street, alone, in the wee hours. *The Texas Tribune*. August 27, 2011. Available at: [www.nytimes.com/2011/08/28/us/28tttrelease.html?pagewanted=all&\\_r=0](http://www.nytimes.com/2011/08/28/us/28tttrelease.html?pagewanted=all&_r=0). Accessed December 14, 2014
104. US Department of Justice, Drug Enforcement Administration, Demand Reduction Program. *Get Smart About Drugs: A Drug Enforcement Agency Resource for Parents*. Available at: <https://www.ncpc.org/resources/files/pdf/celebrate-safe-communities/GSAD-PALM-CARD-JUNE-2011.pdf>. Accessed December 14, 2014
105. National Drug Court Institute, National Council of Juvenile and Family Court Judges. *Juvenile Drug Courts: Strategies in Practice Monograph*. Washington, DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Assistance; 2003. Available at: [www.ncjrs.gov/pdffiles1/bja/197866.pdf](http://www.ncjrs.gov/pdffiles1/bja/197866.pdf). Accessed December 14, 2014
106. National Survey on Drug Use and Health. How youths obtain marijuana. *The NSDUH Report*. March 12, 2004. Available at: [www.samhsa.gov/data/2k4/MJsource/MJsource.pdf](http://www.samhsa.gov/data/2k4/MJsource/MJsource.pdf). Accessed December 14, 2014
107. US Department of Transportation, National Highway Traffic Safety Administration. *State of Knowledge of Drug-Impaired Driving: Final Report*. Publication no. DOT HS 809-642. Washington, DC: National Highway Traffic Safety Administration; 2003. Available at: [www.nhtsa.gov/people/injury/research/StateofKnowledgeDrugs/StateofKnowledgeDrugs/](http://www.nhtsa.gov/people/injury/research/StateofKnowledgeDrugs/StateofKnowledgeDrugs/). Accessed December 14, 2014
108. US Department of Transportation, National Highway Traffic Safety Administration. *Marijuana and Actual Driving Performance: Final Report*. Publication no. 808-078. Washington, DC: National Highway Traffic Safety Administration; 1993. Available at: <http://ntl.bts.gov/lib/25000/25800/25867/DOT-HS-808-078.pdf>. Accessed December 14, 2014
109. Elliot M, Smith A; Marijuana DUI Workgroup. *Recommendation to the Drug Policy Task Force and Colorado Commission on Criminal and Juvenile Justice*. Denver, CO: Medical Marijuana Industry Group; 2011
110. Desrosiers NA, Lee D, Concheiro-Guisan M, Scheidweiler KB, Gorelick DA, Huestis MA. Urinary cannabinoid disposition in occasional and frequent smokers: is THC-glucuronide in sequential urine samples a marker of recent use in frequent smokers? *Clin Chem*. 2014; 60(2):361–372

## The Impact of Marijuana Policies on Youth: Clinical, Research, and Legal Update

Seth Ammerman, Sheryl Ryan, William P. Adelman and THE COMMITTEE ON SUBSTANCE ABUSE, THE COMMITTEE ON ADOLESCENCE

*Pediatrics* 2015;135:e769

DOI: 10.1542/peds.2014-4147 originally published online January 26, 2015;

<b>Updated Information &amp; Services</b>	including high resolution figures, can be found at: <a href="http://pediatrics.aappublications.org/content/135/3/e769">http://pediatrics.aappublications.org/content/135/3/e769</a>
<b>References</b>	This article cites 59 articles, 8 of which you can access for free at: <a href="http://pediatrics.aappublications.org/content/135/3/e769#BIBL">http://pediatrics.aappublications.org/content/135/3/e769#BIBL</a>
<b>Subspecialty Collections</b>	This article, along with others on similar topics, appears in the following collection(s): <b>Current Policy</b> <a href="http://www.aappublications.org/cgi/collection/current_policy">http://www.aappublications.org/cgi/collection/current_policy</a> <b>Committee on Adolescence</b> <a href="http://www.aappublications.org/cgi/collection/committee_on_adolescence">http://www.aappublications.org/cgi/collection/committee_on_adolescence</a> <b>Committee on Substance Use and Prevention</b> <a href="http://www.aappublications.org/cgi/collection/committee_on_substance_abuse">http://www.aappublications.org/cgi/collection/committee_on_substance_abuse</a> <b>Substance Use</b> <a href="http://www.aappublications.org/cgi/collection/substance_abuse_sub">http://www.aappublications.org/cgi/collection/substance_abuse_sub</a>
<b>Permissions &amp; Licensing</b>	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: <a href="http://www.aappublications.org/site/misc/Permissions.xhtml">http://www.aappublications.org/site/misc/Permissions.xhtml</a>
<b>Reprints</b>	Information about ordering reprints can be found online: <a href="http://www.aappublications.org/site/misc/reprints.xhtml">http://www.aappublications.org/site/misc/reprints.xhtml</a>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



# PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## **The Impact of Marijuana Policies on Youth: Clinical, Research, and Legal Update**

Seth Ammerman, Sheryl Ryan, William P. Adelman and THE COMMITTEE ON  
SUBSTANCE ABUSE, THE COMMITTEE ON ADOLESCENCE

*Pediatrics* 2015;135:e769

DOI: 10.1542/peds.2014-4147 originally published online January 26, 2015;

The online version of this article, along with updated information and services, is  
located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/135/3/e769>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2015 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

