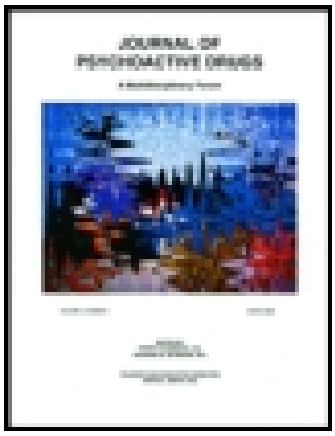

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Medical Cannabis in Arizona: Patient Characteristics, Perceptions, and Impressions of Medical Cannabis Legalization

William D. Troutt, N.M.D. & Matthew D. DiDonato, Ph.D.

Abstract — Many advances have been made toward understanding the benefits of medical cannabis. However, less is known about medical cannabis patients themselves. Prior research has uncovered many important patient characteristics, but most of that work has been conducted with participants in California, who may not represent medical cannabis patients throughout the United States. Furthermore, it is unknown if medical cannabis legalization, which typically imposes strict regulations on cannabis cultivation and sale, impacts patients' experiences acquiring and using cannabis. The goal of this study was to address these limitations by (1) examining the characteristics, perceptions, and behaviors of medical cannabis patients in Arizona; and (2) questioning participants with a history of cannabis use regarding their experiences with cannabis before and after legalization. Patients in Arizona share many characteristics with those in California, but also key differences, such as average age and degree of cannabis consumption. Participants also had positive perceptions of the effect of medical cannabis legalization, reporting that feelings of safety and awareness were higher after legalization compared to before. The results are discussed in relation to evidence from patients in other states and in terms of their potential policy implications.

Keywords — Arizona, medical cannabis, medical cannabis legalization, patient characteristics, perceptions

Support for the use of cannabis for medical purposes is growing throughout the United States. To date, 23 states and the District of Columbia have enacted laws legalizing medical cannabis, and 16 states have similar legislation under consideration. Recent polls also show that the majority of Americans believe that cannabis should be legalized for medical purposes (Anderson Robbins Research & Shaw & Company Research 2013; Associated Press-CNBC 2010), and the popularity of this sentiment has increased over time (Anderson Robbins Research & Shaw & Company Research 2013).

Support may be on the rise, in part, due to research that shows the potential therapeutic effects of medical cannabis. Animal studies, for example, show that cannabis-derived extracts mitigate cancer cell proliferation and tumor growth (Aviello et al. 2012) and have antidepressant-like effects (Jiang et al. 2005). Studies also show that cannabis may be beneficial for humans. Bar-Sela and colleagues (2013) found that nausea, vomiting, weight loss, sleep disorders, and pain were reduced in cancer patients after 6–8 weeks of cannabis use. Studies also show that cannabis significantly reduces chronic pain (see Lynch and Campbell 2011),

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inflammatory bowel disease (Allegretti et al. 2013), posttraumatic stress disorder (Greer, Grob, and Halberstadt 2014), and seizure disorders (Lorenz 2004).

Although many advances have been made in understanding the benefits of medical cannabis, less is known about US medical cannabis patients themselves. Demographically, most patients are White, male, and approximately 35 to 45 years of age (Bonn-Miller et al. 2014; Grella, Rodriguez, and Kim 2014; Ryan-Ibarra, Induni, and Ewing 2015; Aggarwal et al. 2013; Ilgen et al. 2013; Nunberg et al. 2011; Reinarman et al. 2011; Aggarwal et al. 2009; Reiman 2009; O'Connell and Bou-Matar 2007; Harris et al. 2000). Most patients report medicating with cannabis daily (Bonn-Miller et al. 2014; Ilgen et al. 2013; Reinarman et al. 2011; O'Connell and Bou-Matar 2007), consuming six to nine grams of cannabis per week (Bonn-Miller et al. 2014; Reinarman et al. 2011; O'Connell and Bou-Matar 2007), and prefer inhalation as the method of consumption (O'Connell and Bou-Matar 2007).

Studies also show that the majority of patients use medical cannabis to relieve pain. However, patients also report using cannabis to treat a variety of other conditions, including anxiety, sleep apnea, hypertension, incontinence, and depression (Aggarwal et al. 2013; Nunberg et al. 2011; Reinarman et al. 2011). Generally, patients report that medical cannabis is effective for helping them manage their condition(s) (Bonn-Miller et al. 2014; Ryan-Ibarra, Induni, and Ewing 2015; Aggarwal et al. 2013; Harris et al. 2000). For example, Aggarwal and colleagues (2013) found that, on a scale from 1 to 10, where 10 indicated absolute symptom control, patients reported that cannabis provided symptom control in the range of 7 to 10 across a variety of conditions. Patients also often reduce their use of other medications (i.e., prescription and over-the-counter drugs) when using medical cannabis (Nunberg et al. 2011; Aggarwal et al. 2009; Reiman 2009, 2007).

Though these studies are informative, one limitation is that most were conducted with samples of patients living in California. California patients may not represent those living in other areas of the country because the regulations that govern patients in California are different from those in other states. For example, residents of California may legally obtain medical cannabis to treat a number of ailments, including any chronic or persistent condition that considerably limits major life activities or that, if not alleviated, may compromise the patient's safety or health (California Senate Bill 420 2003). Because the list of conditions for which the legal medical use of cannabis is granted in other states is often less inclusive, patients from these states may differ from those in California.

Considering that medical cannabis has been legalized in many states, there is an opportunity to paint a more comprehensive picture of American medical cannabis patients by conducting similar studies in other geographic locations. Scientists have begun to conduct such research through the examination of patients living in Washington State (Aggarwal et al. 2013, 2009) and Michigan (Ilgen et al. 2013). Our first goal was to continue this line of research by studying medical cannabis patients in Arizona. To aid comparisons with previous research, we assessed patient characteristics, behaviors, and perceptions that have been examined in prior studies. These included patterns of use (e.g., frequency of consumption, amount of consumption, preferred method of consumption), degree of relief experienced when using medical cannabis, and use of other medications.

In addition to the limited research on medical cannabis patients outside of California, to our knowledge there has been no systematic examination of patients' perceptions of the outcomes of medical cannabis legalization. One objective of legalizing cannabis for medical use is to safeguard its acquisition and production, which often involves strict regulation of its cultivation and sale. For instance, the rules and regulations of the Arizona Medical Marijuana Program require that those authorized to operate medical cannabis dispensaries and cultivation facilities enact strict security policies and procedures (Arizona Department of Health Services Medical Marijuana Rules 2012). In addition, many dispensaries and facilities employ third-party laboratories to test cannabis products for possible contaminants. However, it is unknown if such regulations translate to changes in patient safety or product quality.

Because individuals who use cannabis medicinally are those most affected by these regulations, surveying patients regarding their experiences purchasing and using medical cannabis may uncover the changes legalization has had on patient safety and product quality. In particular, patients with a history of using cannabis medicinally prior to legalization can provide their perspective on the changes that legalization has generated. The second goal of the present study was to determine the effectiveness of measures invoked to regulate and secure the cultivation and sale of medical cannabis by examining the perceptions of patients that used cannabis medicinally prior to legalization. Patients were asked to compare their perceptions of safety, product knowledge, and the effectiveness of cannabis for treating their condition(s) before and after legalization. Because of the regulations imposed with the legalization of medical cannabis, we hypothesized that patients would feel greater safety, have better knowledge, and that cannabis effectiveness would be greater after legalization.

METHOD

Participants and Procedures

Participants were 367 patients recruited from four medical cannabis dispensaries located throughout Arizona. The majority of the patients were male (63.8%), and

ranged from 18 to 83 years of age (M = 45.78 years; SD = 13.76 years). Most of the patients were White (86.4%), whereas the rest were Hispanic (6.3%), Black (2.5%), Native American (1.9%), Asian (0.8%), or Other (2.1%). These figures are similar to those reported by the Arizona Department of Health Services (2014) for this patient population.

To protect patient confidentiality, the authors did not directly contact patients, but approached dispensary owners to request assistance in recruiting participants. Dispensary owners informed their patients of the study, and interested patients were directed to a website that provided information about the research, including a description of the study, an explanation of patients' rights as participants, and information regarding the collection and storage of participant responses (i.e., responses were anonymous and would be stored on a password-protected server and/or computer only accessible to the researchers). If the patient agreed to participate, he or she checked a box indicating his or her agreement and the survey questions appeared.

Measures

Patient conditions. Participants were asked to select from an extensive list of conditions for which they use medical cannabis to control or treat. For each condition selected, participants completed subsequent questions and rated them on five-point Likert-type scales regarding the degree of relief experienced overall (1 = No relief at all; 5 = Almost complete relief), the degree of relief compared to other medications (1 = Much less relief; 5 = Much more relief), and the use of other medications since using medical cannabis (1 = I use other medications much less frequently; 5 = I use other medications much more frequently). Higher scores indicated greater relief or more frequent use of other medications.

Patterns and methods of cannabis use. Patients reported on the frequency ("On average, how frequently do you medicate with medical cannabis?": "Less than once per month" to "Several times per day") and amount ("On average, how much medical cannabis do you consume in a month?": "Less than one gram" to "More than one ounce") of consumption. Patients also completed a single-item measure regarding their preferred method of consumption (smoking, edibles, tinctures, vaporizing, raw consumption, or oils).

Perceptions of prior medical cannabis users. Participants were asked if they had used cannabis to treat their condition(s) before its legalization in Arizona. Those who replied "yes" were asked to complete four additional items. These items included the perceived safety of acquiring cannabis ("Compared to when you did not have a medical marijuana card, acquiring cannabis as a medical marijuana card holder feels": 1 = Much more dangerous; 5 = Much safer), knowledge of strain characteristics ("Compared to when you did not have a medical marijuana card, your knowledge of what strain you are acquiring and its characteristics is": 1 = Much worse; 5 = Much better), confidence in a safe product ("Compared to when you did not have a medical marijuana card, your confidence that you are receiving a safe, uncontaminated product is": 1 = Much lower; 5 = Much higher), and product effectiveness for treating their condition(s) ("Compared to when you did not have a medical marijuana card, the effectiveness of the cannabis you receive to treat your condition is": 1 = Much worse; 5 = Much better).

RESULTS

The conditions for which patients reported using medical cannabis are displayed in Table 1. Consistent with previous research, the majority of patients reported suffering from chronic pain. Other commonly reported conditions included anxiety, depression, headaches, insomnia, muscle spasms, nausea, and stress.

Figure 1 shows the distributions of patients for frequency of cannabis use (Figure 1A), amount of cannabis consumed per month (Figure 1B), and preferred method of cannabis consumption (Figure 1C). The large majority of patients (83.7%) reported using medical cannabis several times per week or more, with most using medical cannabis daily (61%). Most patients consumed one-half of an ounce of cannabis or less per month (78.1%), and the most popular method of consumption was inhalation (i.e., smoking or vaporizing; 67.2%).

Perceived Effectiveness of Medical Cannabis

Patients' perceptions of the effectiveness of medical cannabis for treating their condition(s) are presented in Table 1. The values reflect the percent of patients who reported experiencing, overall, *a lot of relief* or *almost complete relief* from their symptoms and conditions when using medical cannabis (second column), *a little more relief* or *much more relief* from medical cannabis compared to other medications (third column), and using other medications *a little less frequently* or *much less frequently* when medicating with cannabis (fourth column).

For many of the conditions, patients reported that cannabis was effective for helping them manage their ailments. For example, at least 70% of patients reported experiencing *a lot of relief* or *almost complete relief* for 24 of the 42 conditions. Similarly, for 27 of the 42 conditions, at least 70% of patients reported experiencing *a little more relief* or *much more relief* from medical cannabis compared to other medications. Finally, at least 70% of patients reported using other medications *a little less frequently* or *much less frequently* for 24 of the 42 conditions.

TABLE 1
Percent of Patients Who Experience Relief and Less Frequently Use other Medications Due to Medical Cannabis Use, by Condition

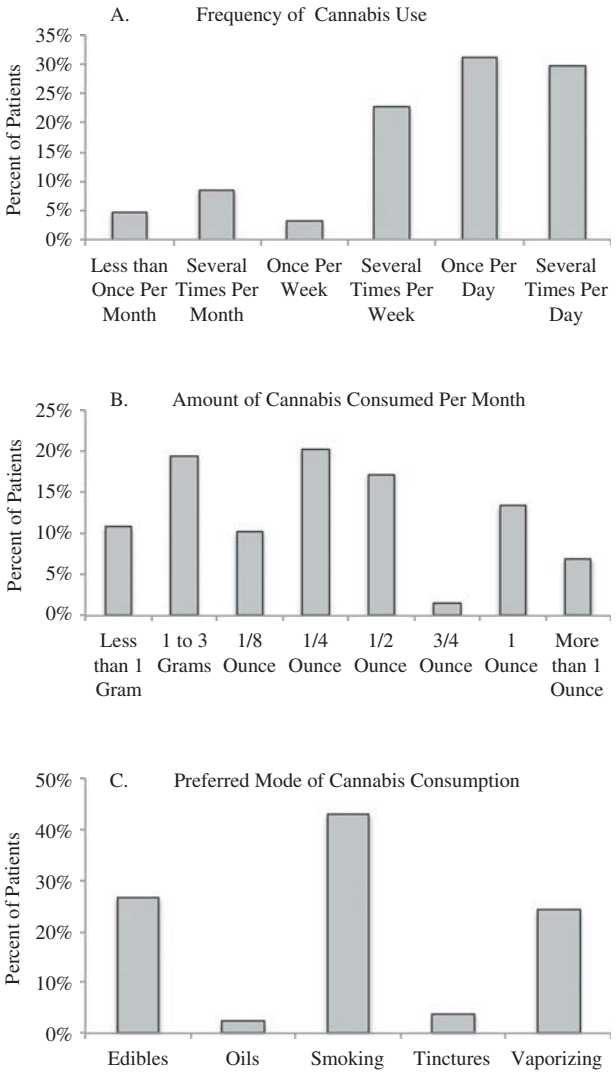
Condition	Number of patients (%)	General relief[a]	Relief compared to other medications[b]	Less frequent use of other medications[c]
Alcohol Dependency	23 (6.3%)	91.30%	100%	100%
Anxiety	181 (49.3%)	82.90%	79.30%	85.90%
Arthritis	90 (24.5%)	63.30%	68.30%	81.20%
Asthma	13 (3.5%)	61.50%	50%	80.00%
ADHD	32 (8.7%)	81.20%	65%	84.60%
Bipolar Disorder	23 (6.3%)	60.90%	90.00%	56.30%
Bowel Distress	38 (10.4%)	78.90%	88.40%	95.40%
Cancer	17 (4.6%)	88.30%	54.60%	78.60%
Carpal Tunnel	15 (4.1%)	40.00%	80.00%	100%
Chronic Pain	318 (86.6%)	76.70%	73.50%	90.20%
Diabetes	26 (7.1%)	38.40%	37.50%	54.10%
Crohn's Disease	14 (3.8%)	85.70%	75%	81.80%
Depression	106 (28.9%)	82.10%	86.90%	65.10%
Fibromyalgia	26 (7.1%)	76.90%	76.20%	93.80%
Glaucoma	9 (2.5%)	55.50%	50.00%	60%
Headaches	106 (28.9%)	68.90%	73.70%	93.80%
Hepatitis C	11 (3.0%)	45.50%	85.80%	28.60%
HIV	1 (0.3%)	100%	100%	—
Huntington's Disease	1 (0.3%)	100%	—	—
Hypertension	26 (7.1%)	65.40%	60.00%	46.60%
Insomnia	145 (39.5%)	82.70%	77.40%	81.90%
Loss of Appetite	67 (18.3%)	79.10%	92.30%	88.90%
Multiple Sclerosis	5 (1.4%)	100%	75.00%	33.30%
Muscle Spasms	130 (35.4%)	76.20%	82.10%	91.40%
Muscular Dystrophy	1 (0.3%)	100%	100%	—
Nausea	105 (28.6%)	85.70%	87.30%	94.80%
Neuropathy	45 (12.3%)	51.10%	69.70%	60.70%
OCD	17 (4.6%)	64.70%	62.50%	33.40%
Opioid Dependency	8 (2.2%)	75%	60.00%	50.00%
Osteoarthritis	39 (10.6%)	61.50%	66.60%	84%
PTSD	28 (7.6%)	67.90%	92.90%	44.40%
Schizophrenia	2 (0.5%)	100%	100%	—
Seizures	15 (4.1%)	80.00%	61.60%	84.70%
Skin Conditions	5 (1.4%)	60.00%	50.00%	50.00%
Sleep Apnea	31 (8.5%)	58.10%	85.00%	66.60%
Stress	164 (44.7%)	87.20%	91.60%	79.10%
Tourette's Syndrome	4 (1.1%)	100%	100%	—
Tremors	6 (1.6%)	50.00%	100%	100%
Vomiting	31 (8.4%)	71.00%	87.50%	82.40%
Wasting	6 (1.6%)	50.00%	66.70%	100%
Weight Loss	24 (6.5%)	62.50%	80.00%	70.00%

[a]The percent of patients with this condition who reported that they experienced a lot or almost complete overall relief.
[b]The percent of patients with this condition who reported that they experienced a lot or almost complete overall relief.
[c]The percent of patients with this condition who reported that they use other medications a little or much less frequently.

Perceived Effects of Medical Cannabis Legalization

Nearly two-thirds of participants ($n = 239$) reported using cannabis medicinally prior to legalization. These patients were asked to compare their current experiences acquiring, their knowledge of, and their experiences using medical cannabis to their experiences and knowledge before legalization. Distributions of the patient's responses are shown in Figure 2. Compared to their experiences

FIGURE 1
Distributions of patient responses, by percentage, for cannabis-related behaviors and perceptions: (A) the frequency of patient's cannabis use; (B) the amount of cannabis consumed by patients per month; (C) patient's preferred mode of cannabis consumption.



before legalization, 89.1% of patients reported that acquiring cannabis after legalization felt *somewhat safer* or *much safer*, 80.3% reported that their knowledge of the cannabis strains they acquired was *somewhat better* or *much better*, 85.4% reported that they had *somewhat more confidence* or *much more confidence* that they were purchasing a safe and uncontaminated product, and 79.5% reported that the medical cannabis was *somewhat more effective* or *much more effective* for treating their condition(s).

DISCUSSION

The goals of this study were to (1) examine the characteristics, perceptions, and behaviors of medical cannabis patients in Arizona; and (2) question participants with a history of cannabis use regarding their perceptions of safety acquiring cannabis, the quality of the cannabis they have obtained, their knowledge of the cannabis, and its perceived effectiveness, before and after legalization.

Patient Characteristics, Perceptions, and Behaviors

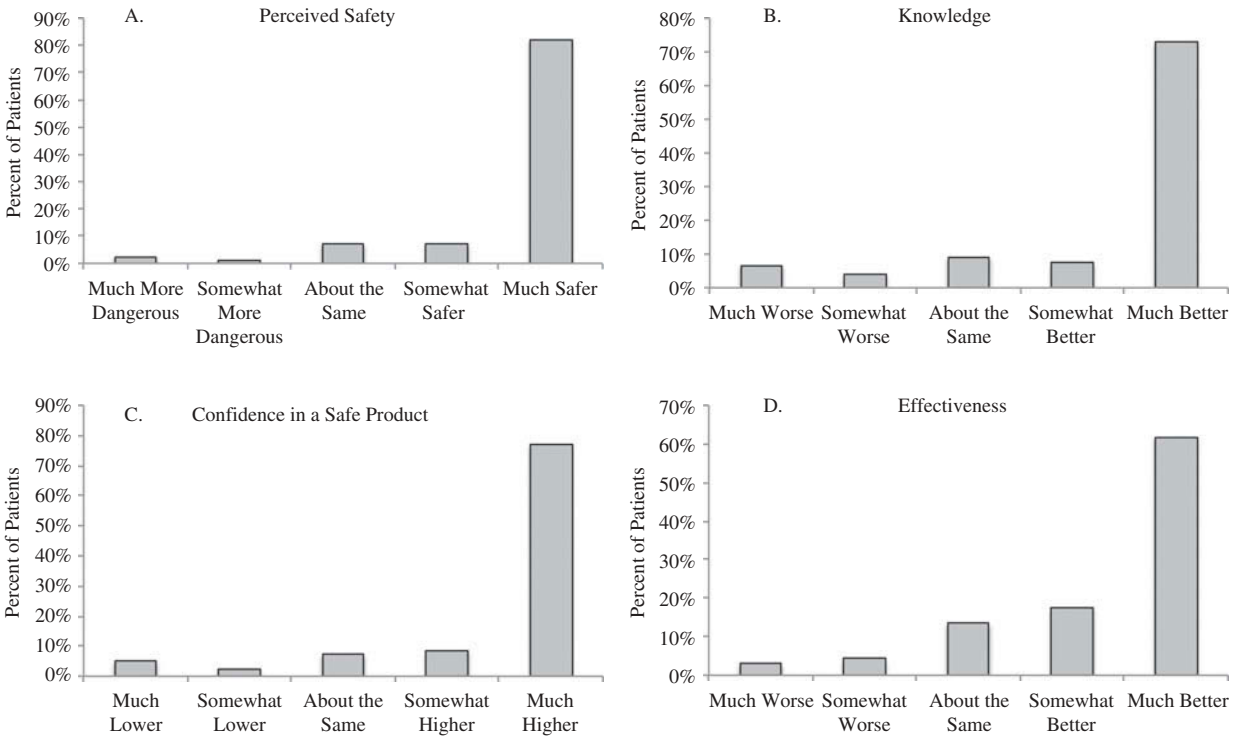
Consistent with research in other states (Bonn-Miller et al. 2014; Aggarwal et al. 2013; Ilgen et al. 2013; Nunberg et al. 2011; Reinarman et al. 2011; Aggarwal et al. 2009; Reiman 2009; O'Connell and Bou-Matar 2007; Harris et al. 2000), participants in the present study were mostly White men. Average patient age, approximately 46 years, differed from that in other states. For example, average ages reported in studies of patients from California range from 28 to 41 years (Bonn-Miller et al. 2014; Grella, Rodriguez, and Kim 2014; Reiman 2009, 2007; Harris et al. 2000). Average patient age is somewhat higher in Colorado (42 years of age; Colorado Department of Public Health and Environment 2014) and Washington State (41 to 47 years of age; Aggarwal et al. 2013, 2009). In Michigan (46 years of age; Murphy 2013) and Montana (47 years of age; Montana Department of Public Health and Human Services 2014), average patient age more closely approximates that of Arizona.

State-level variation in the average age of medical cannabis patients may in part be explained by the conditions that qualify a person to use medical cannabis in each state. For example, the qualifying conditions in Arizona, Colorado, Montana, Michigan, and Washington State are less inclusive than those in California, and are generally limited to more debilitating diseases. Individuals who suffer from more serious conditions may also be older, which may account for higher average patient ages in states other than California. The variability in these statistics underscores the risk of generalizing findings from patients living in California to those residing in other states and highlights the importance of studying patients throughout the United States. State-level differences in regulations also present an opportunity to explore how such regulations shape patient characteristics. A potential avenue for future work may be to study and compare patients in all states that have legalized the medical use of cannabis, ideally using a national sample to aid state-level comparisons.

Participants in the present study reported that, on average, they consumed cannabis on a daily basis and that inhalation was the preferred method of consumption, patterns of use that reflect those found in prior work (Bonn-Miller et al. 2014; Ilgen et al. 2013; Reinarman et al. 2011; O'Connell and Bou-Matar 2007). However, previous research shows that patients consume between

FIGURE 2

Distributions of patient responses, by percentage, of their current experiences acquiring and knowledge of medical cannabis compared to their experiences before legalization: (A) the perceived safety of acquiring cannabis; (B) knowledge of medical cannabis characteristics; (C) perceived confidence in a safe product; and (D) perceived effectiveness of cannabis for treating their condition(s).



six and nine grams of cannabis per week or, equivalently, 0.85 to 1.25 ounces per month (Bonn-Miller et al. 2014; Reinarman et al. 2011; O'Connell and Bou-Matar 2007). This is in contrast to the findings of the present study, which show that 78% of patients consumed 0.5 ounces of cannabis per month or less.

State-level differences in average patient age, in particular, may affect variation in consumption. Patients in Arizona are, on average, older than those in California, and older patients may consume less cannabis than younger patients. Evidence from the present study supports this hypothesis, as there is a small, but significant, negative correlation between age and the amount of cannabis consumed per month ($r = -.11$, $p < .05$). Relatedly, Grella and colleagues (2014) found that younger patients visited dispensaries more frequently than older patients. Although there are likely other factors that contribute to consumption disparities, these findings also highlight the importance of studying medical cannabis patients across the US.

Patients reported using medical cannabis to treat a variety of conditions. The most commonly reported conditions included chronic pain, muscle spasms, nausea, anxiety, arthritis, depression, headaches, insomnia, and stress. Patients also reported that cannabis was effective for treating the symptoms of many of these conditions, findings that are consistent with previous research (Bonn-Miller et al. 2014; Ryan-Ibarra, Induni, and Ewing 2015; Aggarwal et al. 2013; Harris et al. 2000). This effectiveness included feelings of general relief and relief compared to other medications. The conditions for which the highest proportions of patients reported relief included alcohol dependency, anxiety, bowel distress, depression, insomnia, muscle spasms, and stress. Furthermore, patients reported using other medications less frequently when using cannabis. This is consistent with findings from other studies of patient perceptions (Reiman 2007, 2009; Nunberg et al. 2011; Reinarman et al. 2011), as well as a study of opiate overdose mortality, which showed that states with legalized medical cannabis had significantly lower opiate overdose mortality compared

to those without legalized medical cannabis (Bachhuber et al. 2014).

Medical cannabis may benefit Arizona patients suffering from a variety of conditions. This conclusion has potential policy implications, as patients report deriving benefit not only for conditions that fall under the list of conditions that qualify a person to use medical cannabis (e.g., cancer, chronic pain, muscle spasms), but also for conditions that are not listed (e.g., anxiety, depression, insomnia). Officials in Arizona previously considered research on post-traumatic stress disorder (PTSD; Greer, Grob, and Halberstadt 2014) in their decision to include PTSD among Arizona's qualifying conditions. Thus, officials may consider the findings from the present study, in conjunction with other research, to determine the suitability of expanding the list of qualifying conditions in Arizona.

Legalization and Patient Experiences

The present study was, to our knowledge, the first to examine the effect of legalization on patient's experiences with medical cannabis. Regarding safety, the majority of patients reported feeling safer acquiring medical cannabis after legalization, and their confidence that they were acquiring a safe, uncontaminated product was higher. Patients also reported that their knowledge of the strains they acquired was better and that the cannabis they acquired after legalization was more effective for treating their condition(s) than the cannabis they acquired before legalization.

These findings show that the Arizona medical cannabis program has had some success, as regulations have provided a safe environment for patients to acquire a safe and high-quality product. However, the potential negative effects of medical cannabis legalization were not assessed in the present study. For example, participants in other studies have reported difficulties affording legal medical cannabis (Aggarwal et al. 2009), a factor which may preclude some individuals from taking advantage of the program, leaving them seeking other, potentially illegal means of cannabis acquisition. Other factors, such as limits on the amount of cannabis that can be purchased or legal issues related to medical cannabis use, may also have negative consequences for some segments of the patient population.

The results of this study should be considered in light of some limitations. First, participant recruitment was conducted through medical cannabis dispensaries. Although this is a common method of recruitment (e.g., Bonn-Miller et al. 2014; Grella, Rodriguez, and Kim 2014; Aggarwal et al. 2013; Reiman 2009, 2007; Harris et al. 2000), such samples may have a positive bias for medical cannabis, as individuals who medicate with cannabis but for whom it was not effective are unlikely to be available to participate. However, at least one study using a large, representative sample of current and former medical cannabis users reported similar findings (Ryan-Ibarra, Induni, and Ewing 2015), lending validity to the results of the present study and those of previous research. Second, relatively few patients reported using medical cannabis for some of the conditions. Although this is not surprising, given the low incidence of some conditions, conclusions should be tempered for these conditions with respect to the effectiveness of medical cannabis for providing relief and/or for use as a substitute for other medications. Finally, patients' experiences acquiring and their knowledge of medical cannabis before and after legalization were assessed retrospectively, using a single measurement time-point.

Despite these limitations, this study has significance for understanding the characteristics, behaviors, and perceptions of Arizona medical cannabis patients. Additionally, it highlights the importance of studying patients throughout the US and understanding the potential effects of state-level regulatory differences on patient populations. The findings regarding the effectiveness of cannabis for treating various conditions have potential policy implications for the state of Arizona, as patients reported that cannabis was effective for treating conditions that currently do not qualify individuals for medical cannabis use. Furthermore, the results showed that the majority of patients report positive experiences as a result of legalization, although more work is needed to fully understand the consequences of Arizona's medical cannabis program.

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