Marijuana Use Among Patients With Glaucoma in a City With Legalized Medical Marijuana Use

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**IMPORTANCE** Previous research has shown several limitations associated with the use of marijuana as a treatment for glaucoma. However, little is known regarding patients’ perceptions toward using marijuana for glaucoma and their intentions to use this therapeutic alternative.

**OBJECTIVE** To identify factors among patients with glaucoma that could lead to intentions to use marijuana for treatment.

**DESIGN, SETTING, AND PARTICIPANTS** This cross-sectional survey study of 204 patients with glaucoma or suspected to have glaucoma was conducted at an academic-based glaucoma clinic in Washington, DC, between February 1 and July 31, 2013. Patients completed a self-administered survey assessing demographics, perceived severity of glaucoma, prior knowledge about marijuana use in glaucoma, past marijuana use, perceptions toward marijuana use (legality, systemic adverse effects, safety and effectiveness, and false beliefs), satisfaction with current glaucoma management, relevance of treatment costs, and intentions to use marijuana for glaucoma. Medical records were reviewed for disease severity. Data analysis was conducted from September 1, 2013, to September 30, 2015.

**MAIN OUTCOMES AND MEASURES** The main outcome was patients’ intentions to use marijuana for glaucoma. Multiple linear regression analysis was conducted to identify factors associated with patients’ intentions to use marijuana for glaucoma.

**RESULTS** Of the 334 patients who were invited to participate in the study, 204 (61.1%) completed the survey. About half the participants were women (104 [51.0%]), and 82 (40.2%) were white. Regression analysis of 204 respondents indicated that perceptions of legality of marijuana use (β, 0.378; 95% CI, 0.205 to 0.444; P < .001), false beliefs regarding marijuana (β, 0.323; 95% CI, 0.236 to 0.504; P < .001), satisfaction with current glaucoma care (β, -0.222; 95% CI, -0.362 to -0.128; P < .001), and relevance of marijuana and glaucoma treatment costs (β, 0.127; 95% CI, 0.008 to 0.210; P = .04) were significantly associated with intentions to use marijuana for glaucoma treatment after controlling for demographic variables, disease severity, and previous marijuana use.

**CONCLUSIONS AND RELEVANCE** This study’s findings suggest a need for more education on this topic for ophthalmologists to be able to protect patients with glaucoma against the increased acceptability among the public of using marijuana based on false perceptions of its therapeutic value in glaucoma therapy. Considering the strong influence of perceptions of the legality of marijuana use on intentions to use this substance as a treatment for glaucoma, patient education might be particularly relevant in states in which marijuana use for glaucoma is legal, as in the case of the current study’s setting.
Glaucoma is the second leading cause worldwide of preventable, irreversible blindness, as reported by the World Health Organization. It is estimated that 2.2 million adults in the United States are affected by glaucoma, and this figure is expected to increase to 3.3 million by 2020. Glaucoma is currently managed by topical medications, laser surgery, and non-laser surgery. Alternative therapies for glaucoma are being explored but have not presently shown promise. The most prominent of these therapies is the use of cannabis, also known as marijuana. Among the more than 400 chemicals that are present in marijuana, delta-9-tetrahydrocannabinol is the main component that is thought to be responsible for most of its physiological effects. When used for treatment of glaucoma, marijuana has been shown to lower intraocular pressure but its effects are limited to 3 to 4 hours, requiring dosing 8 to 10 times per day for sustained therapeutic effect. Furthermore, only 60% to 65% of individuals experience intraocular pressure reduction with the use of marijuana. Beyond its physiological effects, the use of marijuana in medicine and specifically glaucoma has recently experienced a great deal of legal amendments.

Driven mainly by public support, 21 states and the District of Columbia have legalized the medical use of marijuana, citing mainly the 1999 Institute of Medicine report that found possible therapeutic benefits for the use of marijuana in various debilitating medical conditions, including multiple sclerosis, human immunodeficiency virus and AIDS, and cancer, as well as glaucoma. Among the states that have legalized the medical use of marijuana, there exist differences in standards for patient qualifications, practitioner requirements, and limits of the amount of marijuana an individual can possess. However, federal laws still prohibit growing and possessing marijuana, largely based on the Controlled Substance Act of 1971. This stance has been reiterated repeatedly by the Department of Justice and the Drug Enforcement Agency, which classifies cannabis as an illegal schedule 1 drug that has no acceptable medical use. In addition, various medical associations have so far rejected endorsing the state-based medical cannabis programs and the legalization of marijuana given the lack of scientific evidence that supports its use for medical conditions. In a statement issued in 2010, the American Glaucoma Society recommended against the use of marijuana in the treatment of glaucoma given its short duration of action, its documented adverse effects, and the lack of scientific evidence so far that its use could alter the course of glaucoma.

Given the explosion of legal changes regarding the medical use of marijuana, glaucoma physicians are approached with patient inquiries about treatment of their glaucoma with this alternative therapy. To better address these questions, it is important for physicians to understand patients’ perceptions toward marijuana use. However, most of what is known about the epidemiological determinants of marijuana use comes from surveys that do not distinguish between medical, recreational, or illicit pathologic uses. As more states legalize marijuana for medical uses, more research is needed to describe the patient population that is seeking to use marijuana in clinical settings and to answer the question “Why would patients seek to use marijuana?”

This study explores the perceptions that patients have toward using marijuana for glaucoma and aims to identify factors associated with intentions to use marijuana in the treatment of glaucoma among patients visiting the glaucoma clinic at the Medical Faculty Associates, given the legalization of marijuana use in glaucoma treatment in the District of Columbia since 2010. To attain these objectives, a survey was created through a collaborative effort with the help of glaucoma experts at the department of ophthalmology and psychologists at the department of psychology at The George Washington University.

Methods

A cross-sectional survey study was conducted between February 1 and July 31, 2013 of a consecutive sample of 334 patients with glaucoma visiting the glaucoma clinic at the Medical Faculty Associates. Data analysis was conducted September 1, 2013, to September 30, 2013. The study was approved through the George Washington University Institutional Review Board. Written informed consent was obtained from all participants and this work is compliant with the Health Insurance Portability and Accountability Act. The research adhered to the tenets of the Declaration of Helsinki. Patients were included if they were between 18 and 90 years and were either diagnosed with glaucoma or suspected to have glaucoma. After completing the survey, each participant received a copy of the signed consent form and was given a copy of the American Glaucoma Society statement on the use of marijuana in the treatment of glaucoma.

Patients completed a self-administered survey with 2 parts. The first part included questions regarding demographic information (ie, age, sex, race, and level of education), perceived diagnosis, perceived severity of glaucoma, previous knowledge about the use of marijuana for the treatment of glaucoma and sources of such information (eg, Internet and friends), and history of marijuana use in the past (differentiated by recreational use, use for glaucoma, and use for other medical conditions) and the frequency of such use.

At a Glance

- This study was conducted to fill gaps in knowledge about patients’ perceptions toward using marijuana for glaucoma and their intentions to seek this therapeutic alternative.
- Intentions to use marijuana were generally modest (mean [SD] score, 2.36 [0.86] on a scale of 1 to 5).
- The perception that marijuana should be legal was associated with the intention to use marijuana for glaucoma treatment.
- An association of glaucoma disease severity with the intention to use marijuana was not identified.
- Considering the influence of perceptions of the legality of marijuana use, patient education might be particularly relevant in states in which use of marijuana for glaucoma treatment is legal.
For the second part of the survey, the research team developed several items to evaluate patients’ intentions to use marijuana, as well as factors that could be associated with those intentions. These items were assessed by 5 independent judges who are experts in ophthalmology and glaucoma, health psychology, and psychometrics. Based on the judges’ feedback, 25 items were included in the final survey (eAppendix in the Supplement). Five of these items measured intentions to use marijuana (Table 1). Using exploratory factor analysis, the remaining 20 items were classified into the 6 following factors: perceptions of legality and acceptability of marijuana use (3 items), systemic adverse effects of marijuana use (2 items), safety and effectiveness of marijuana as a treatment for glaucoma (6 items), false beliefs regarding the use of marijuana for glaucoma (3 items) (these included information that contradicts current scientific evidence about the effects of marijuana treatment on glaucoma), relevance of the costs of treatment (3 items), and satisfaction with current management of glaucoma (3 items). Cronbach α indicate acceptable levels of reliability for all factors (Table 1).

In addition, each patient’s medical record was reviewed for severity of glaucoma. Parameters recorded from the medical record included result of visual acuity testing, number of glaucoma medications used, number of laser surgical procedures, number of non-laser surgical procedures, number of failed non-laser surgical procedures, and severity of results of Humphrey Visual Field testing (which were based on International Statistical Classification of Diseases, 10th Revision, code classification). A multiple linear regression analysis was conducted to identify factors associated with patients’ intentions to use marijuana for glaucoma. All statistical analysis was performed with SPSS software, version 21 (SPSS Inc).

### Results

Of the 334 patients who were invited to participate in the study, 204 (61.1%) completed the survey. Participants’ ages ranged from 23 to 87 years (mean [SD] 63.8 [11.9] years). About half of the 204 participants were women (104 [51.0%]), and 82 (40.2%) were white. The sample was highly educated in general, with 140 (68.6%) having at least a college degree. According to the information in the medical record, 137 participants (67.2%) had a diagnosis of glaucoma, while 67 (32.8%) were suspected to have glaucoma. Table 2 presents more detailed information regarding glaucoma diagnosis, both self-reported and from medical records. Patients tended to underestimate the severity of their documented visual field loss.

More than half the participants (122 [59.8%]) reported knowing about the possible use of marijuana to treat glaucoma before participating in the survey. Television was the most frequently mentioned source of information about marijuana to treat this condition (147 [72.1%]), followed by the newspaper (132 [64.7%]), Internet (67 [32.8%]), radio (65 [31.9%]), friends (47 [23.0%]), and family members (26 [12.7%]).

<table>
<thead>
<tr>
<th>Factor</th>
<th>No. of Items</th>
<th>Example Item</th>
<th>Cronbach α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentions to use marijuana for glaucoma treatment</td>
<td>5</td>
<td>I would be interested in using medical marijuana for my glaucoma condition even if it costs more than regular glaucoma medicines.</td>
<td>.83</td>
</tr>
<tr>
<td>Perceptions of legality and acceptability of marijuana use</td>
<td>3</td>
<td>I believe marijuana use for medical purposes, including glaucoma, should be legal in all states.</td>
<td>.79</td>
</tr>
<tr>
<td>Systemic adverse effects of marijuana use</td>
<td>2</td>
<td>Safety and effectiveness of marijuana as a treatment for glaucoma</td>
<td>.79</td>
</tr>
<tr>
<td>Safety and effectiveness of marijuana as a treatment for glaucoma</td>
<td>6</td>
<td>Relevance of costs of treatment</td>
<td>.75</td>
</tr>
<tr>
<td>False beliefs regarding the use of marijuana for glaucoma</td>
<td>3</td>
<td>Systemic adverse effects of marijuana use</td>
<td>.79</td>
</tr>
<tr>
<td>Relevance of costs of treatment</td>
<td>3</td>
<td>Safety and effectiveness of marijuana as a treatment for glaucoma</td>
<td>.85</td>
</tr>
<tr>
<td>Satisfaction with current glaucoma management</td>
<td>3</td>
<td>I believe my current glaucoma medications effectively control my glaucoma.</td>
<td>.88</td>
</tr>
</tbody>
</table>

Table 1. Factors Assessed in the Survey
while false beliefs about the role of marijuana in the prevention and treatment of glaucoma were rare. The sample tended to be satisfied with their current glaucoma management and reported low levels of concerns regarding costs of glaucoma treatment.

Simple correlations (Pearson product moment or Spearman signed rank) were used to assess the association between intentions to use marijuana for glaucoma and each variable, independent of all other variables included in the study. As can be seen in Table 3, younger age and lower educational level were correlated with higher intentions to use marijuana for glaucoma. Participants who knew about the use of marijuana for glaucoma and those who had used marijuana for recreational purposes or for glaucoma had higher intentions to use it for glaucoma treatment. Perceptions of legality and acceptability of marijuana use, perceived safety and effectiveness of marijuana as a treatment for glaucoma, false beliefs regarding the use of marijuana for glaucoma, and relevance of costs of treatment were positively associated with intentions to use marijuana for glaucoma treatment while perceptions of systemic adverse effects of marijuana and satisfaction with current glaucoma management were negatively associated with such intentions. Sex, race, previous marijuana use for other medical conditions, and the glaucoma diagnosis and severity (both self-reported and from medical records) were not significantly associated with intentions to use marijuana for glaucoma treatment.

A multiple linear regression was used to identify factors that led to patients’ intentions to use marijuana for glaucoma treatment. This multivariable regression model included demographic variables (ie, age, sex, and educational level), information from the medical records regarding severity of diagnosis and visual acuity for both eyes, previous knowledge of marijuana use for glaucoma, history of marijuana use (ie, recreational, for glaucoma, and for other medical conditions), perceptions about use of marijuana for glaucoma (ie, legality and acceptability, systemic adverse effects, safety and effectiveness, and false beliefs), relevance of treatment costs, and satisfaction with current glaucoma management. Information on self-reported diagnoses, as well as information obtained from medical records regarding the number of surgical procedures and laser procedures the patients had undergone and number of medications the patients had taken, were not included in these analyses.
in the regression analysis because these variables were highly correlated with severity of glaucoma (correlations ranged from 0.36 to 0.77). This multivariable model explained 60% of the variance in intentions to use marijuana as a treatment for glaucoma. Of all the variables included, only perceptions of the legality of marijuana use, false beliefs regarding the role of marijuana in the prevention and treatment of glaucoma, satisfaction with current glaucoma care, and relevance of the costs of marijuana and glaucoma treatment were significantly associated with intentions to use marijuana for glaucoma treatment (Table 4).

### Discussion

To our knowledge, this is the first study that describes the demographic and clinical characteristics of patients with glaucoma relative to their intentions to use marijuana as a glaucoma treatment. It also evaluated patients’ perceptions toward using marijuana and sought to identify factors that could lead to intentions to use marijuana for the treatment of glaucoma. While the intentions to use marijuana in our sample of patients were generally low, we suspect that this figure will change dramatically given increased public support for legalizing marijuana for medical and recreational purposes and the wider media coverage of this topic in recent years.

Our results showed that perception of the legality and acceptability of marijuana use was significantly associated with intentions to use marijuana for the treatment of glaucoma. This finding is consistent with the fast and steady increase in the number of states that have legalized marijuana in recent years. Although marijuana was perceived as an illegal drug by the majority of the public throughout the second half of the 20th century, there has been a significant shift in the public attitude, with an increased social acceptability of marijuana since California first legalized its use for medicinal purposes in 1996.11

Another factor found to be associated with intentions to use marijuana for glaucoma treatment was false beliefs regarding the usefulness of this alternative therapy in the prevention or treatment of glaucoma. While, in general, these false beliefs were uncommon among the patients surveyed in this study, patients who held these beliefs were more likely to report higher intentions to seek marijuana to treat their condition. Similarly, lower perceptions of the relevance of the costs of treatment and lower satisfaction with current glaucoma management were significant predictors of intentions to use marijuana for glaucoma.

Our findings suggest a need for more education on this topic to protect patients with glaucoma against the increased acceptability among the public toward using marijuana based on false perceptions of its therapeutic value in glaucoma therapy. One strategy to improve the awareness by patients with glaucoma is to work on changing the unrealistic beliefs that patients might have regarding the efficacy of marijuana and improving their satisfaction toward their current glaucoma management. Our findings were independent of severity of disease or educational level, indicating that all patients would benefit from education on the limitations of marijuana use in glaucoma therapy. Although it is true that marijuana does lower intraocular pressure, we must educate our patients on the limited effects, the frequent dosing required for therapeutic effect, and the unacceptably high number of adverse effects that come with this frequent dosing. We must underscore the difference between the acceptability of marijuana legally and socially vs medically. However, we must also instill hope for future alternative therapies and inform our patients of ongoing research into alternate forms of delivery of delta-9-tetrahydrocannabinol for reduction of intraocular pressure along with research on other drugs and devices. The American Glaucoma Society position paper on marijuana and the treatment of glaucoma8 is a valuable tool to educate patients on the use of marijuana for medicinal purposes. In our experience, reviewing this statement with patients helps them to gain a better understanding of the role of marijuana for the treatment of glaucoma and to decrease their intentions to seek this alternative therapy.

In interpreting the findings of this study, it is important to take into account that it was conducted in Washington, DC, where the use of marijuana for medicinal purposes is legal. Therefore, the results of the study may not be generalizable to places where the use of marijuana has not been legalized. Future studies could evaluate how the factors included in the present study are differently associated with intentions to use marijuana for glaucoma treatment depending on whether this use is legal.

Some limitations in our study warrant discussion. First, participants’ responses are dependent on fatigue or memory on the subject matter. Similarly, considering the delicate legal nature of marijuana use, respondents may have felt uncomfortable responding to the survey. To reduce this self-presentation bias, survey administration favored confidentiality and respondents were reminded that only the research team would have access to their responses. Second, although the response rate in our study is above 60%, data collected and conclusions are based on patients who chose to respond to the survey, possibly creating a nonrespondent bias. In fact, nonwhite participants were less likely to participate in the survey (59.8%) when they were compared with the patients with glaucoma who visited the glaucoma clinic in 2013 (74.0% nonwhite participants). This finding suggests that our results should be interpreted with caution. The study participants were also slightly younger than the population of the clinic for that year (63.8 vs 67.1 years) and less likely to be female (51.0% vs

### Table 4. Multiple Linear Regression Predicting Intentions to Use Marijuana for Glaucoma

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Standardized β (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptions of legality and acceptability</td>
<td>.378 (.205 to .444)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>False beliefs about marijuana use for glaucoma treatment</td>
<td>.323 (.236 to .504)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Satisfaction with current glaucoma management</td>
<td>-.222 (-.362 to -.128)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Relevance of costs of treatment</td>
<td>.127 (.008 to .210)</td>
<td>.04</td>
</tr>
</tbody>
</table>

*Only significant contributors are included in the table."
57.0%). However, a difference was not identified in terms of age and sex between the 2 populations. Finally, the items measuring the main factors included in the analysis were developed specifically for the present study, and future research is needed to further assess their reliability and validity.

Conclusions

These limitations notwithstanding, this study contributes to filling the gap in our knowledge about patients’ perceptions toward using marijuana for glaucoma and their intentions to seek this therapeutic alternative. Understanding these intentions will become even more important as states continue to legalize marijuana for recreational use (currently Washington, DC, and 4 other states), as patients with glaucoma will then have access to marijuana without the need for a physician to prescribe this drug. This survey study is a reminder for physicians, general ophthalmologists, and glaucoma specialists to educate patients with glaucoma on the efficacy and adverse effects of marijuana as it applies to treating glaucoma. Intentions to use marijuana were not based on severity of disease but on false beliefs about the role of marijuana in the prevention and treatment of glaucoma, perceptions that marijuana should be legal, lower perceptions of the relevance of costs of treatment, and lower satisfaction with current glaucoma management. By educating our patients, we can perhaps increase their understanding of the disease process, increase satisfaction with treatment, and increase compliance with therapy.

REFERENCES