Colorado Medical Students' Attitudes and Beliefs About Marijuana

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BACKGROUND: Over the past two decades, state and local governments across the U.S. have been increasingly reforming marijuana laws. Despite growing support for marijuana as a medical treatment, little is known about medical students' perceptions of marijuana use.

OBJECTIVE: To assess Colorado medical students' personal and professional opinions on current and future marijuana use in a healthcare setting.

DESIGN: A voluntary, anonymous, online cross-sectional survey.

PARTICIPANTS: Medical students ($n=624$) at the University of Colorado School of Medicine between January and February 2014 were invited to participate.

MAIN MEASURES: Numerical responses were quantified using counts and percentages, and Likert scale responses were collapsed for bivariate analysis. Items were gathered thematically and additively scored for each subscale. Internal consistency reliability statistics were calculated for each subscale to ensure that items were assessing similar constructs. Unadjusted t tests and one-way analysis of variance (ANOVA) were used to calculate mean differences in subscale scores between subgroups.

KEY RESULTS: We received 236 responses (37%). Students indicated support for marijuana legalization (64%), and few believed that physicians should be penalized for recommending marijuana to patients (6%). Nearly all (97%) believed that further marijuana research should be conducted, and believed marijuana could play a role in the treatment of various medical conditions. Seventy-seven percent reported that they believed marijuana use had the potential for psychological harm, and 68% indicated concern for potential physical harm. Only a minority of students would recommend marijuana to a patient under current law (29%), or if it were legally available (45%). Acceptability of marijuana for treatment of approved conditions was not correlated with age or gender, but was positively correlated with living in Colorado prior to medical school ($p < 0.001$) and with prior marijuana use ($p < 0.001$).

CONCLUSIONS: Medical students support marijuana legal reform, medicinal uses of marijuana, and increased research, but have concerns regarding risks of marijuana

use, and appear hesitant to recommend marijuana to patients.

KEY WORDS: medical culture; medical education; substance abuse; doctor-patient relationships; psychometrics.

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INTRODUCTION

Colorado has long been at the forefront of marijuana legal reforms, including the creation of a medical marijuana (MMJ) program for approved conditions. MMJ became available in Colorado following passage of Amendment 20 in 2000, becoming an expansive clinical industry over the intervening years. Reports from 2014 estimated that MMJ had been “recommended” (the formal process requiring the approval of a physician) to over 278,000 patients through the state’s registry, with 117,239 persons contemporaneously possessing a valid “red card”¹—approximately 2% of the state’s total population.² Colorado’s additional legal reforms, including a 2006 state constitutional amendment decriminalizing marijuana, full legalization for recreational use by adults in 2012,³ and opening of marijuana retail establishments on January 1, 2014,⁴ have not substantially altered the size or scope of the MMJ industry. However, these measures were passed by way of a democratic process, rather than rulemaking along the lines of medical necessity (e.g., Food and Drug Administration [FDA] approval).

Prior studies have looked at the opinion of physicians—although not of medical students—on the topic of MMJ, with diverse findings. A 2005 national study of physicians found physician favorability to be evenly divided on the matter.⁵ A 1990 survey of oncologists reported that 33% of respondents indicated that marijuana should be accepted as medical treatment, and that 53% of those expressing an opinion believed marijuana should be available by prescription.⁶ More recently, a 2013 study of Colorado family physicians showed that only 19% of respondents believed that physicians should recommend MMJ.⁷

University of Colorado medical students, by virtue of attending the only allopathic medical school in Colorado, can provide unique insight into training and practicing in a state with widespread availability, use, and political acceptability of

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marijuana. This study presents the results of a survey of University of Colorado medical students about their personal and professional opinions on current and future marijuana use in a healthcare setting. We hypothesize that Colorado medical students will have a tolerant attitude toward marijuana use in healthcare settings.

METHODS

Study Design

A cross-sectional survey exploring attitudes and beliefs related to MMJ was distributed to all medical students at the University of Colorado School of Medicine (Aurora, CO).

Participants/Recruitment/Data Collection

The survey was distributed via email to 624 medical students beginning in January 2014 via Google Forms. Reminders were both sent via university email and placed throughout campus buildings and shared on class-wide online forums. The survey was open for 45 days. No incentive or compensation was provided for participation.

Survey Development

Items were chosen based on literature review and experiences with MMJ in educational and clinical settings in the following domains: opinions on legal reform, opinions on medical usefulness of MMJ, beliefs in risk and/or benefits associated with MMJ, support for MMJ training and research, and opinions about consequences for physicians who recommend MMJ for their patients ([Online Appendix](#)). Several items were created by adapting those appearing in previously published studies by addressing the trainee's perspective rather than that of a practicing provider.^{6,7} Questions that were not based on previously used questions were developed de novo by the team, which consisted of medical students and faculty. Care was taken to adhere to pre-established principles of survey question design in terms of question format, structure, grouping, and sequence.⁸ Questions were reviewed and revised for clarity and relevance numerous times by the team to ensure that participants understood them and that responses were capturing what the investigators intended. The majority of novel questions were developed by medical students to ensure that content and vocabulary was appropriate to the medical student experience. The survey went through multiple iterations prior to distribution.

Each item asked participants to rate their agreement with various statements on a six-point Likert scale, with responses ranging from "strongly agree" to "strongly disagree" (or "very unacceptable" to "very acceptable" for questions regarding the acceptability of MMJ in medical treatment). Additional questions were asked regarding the sources from which they had learned about marijuana, including several free-response sections. All survey participants were asked demographic

questions, including age, sex, prior personal marijuana use, and future career plans.

The study design, protocol, and survey instrument were granted exempt status by the Colorado Multiple Institutional Review Board prior to administration (COMIRB Protocol 13–2387). No external funding was received for the study.

Data Analysis

Responses were downloaded from the survey software into Microsoft Excel (2011), and initial numerical analyses were performed using this software. Numerical responses were quantified and summarized using counts and percentages. To allow for bivariate comparisons, we collapsed Likert scale item responses into "agree" (somewhat agree, agree and strongly agree) and "disagree" (somewhat disagree, disagree and strongly disagree). Additional statistical analyses were performed using SPSS software (version 23; IBM Corp., Armonk, NY). Items were grouped according to six constructs: 1) acceptability of MMJ for treatment of approved conditions in Colorado, 2) belief that marijuana use has medical benefits, 3) belief that marijuana use has medical risks, 4) support for marijuana legal reform, 5) support for MMJ training and research, and 6) support for adverse consequences for physicians who recommend MMJ for their patients. Internal consistency reliability statistics were calculated for each subscale to ensure that items were assessing similar constructs. Scores on these constructs were calculated and analyzed for differences according to respondent age, gender, reported history of marijuana use, and whether they had lived in Colorado prior to medical school. To evaluate the mean differences in subscale survey scores between subgroups, independent samples *t* tests or one-way analysis of variance (ANOVA; both including the Bonferroni correction for multiple comparisons) were conducted where appropriate. Statistical analyses were performed in an exploratory manner without a specific or explicit a priori hypothesis.

RESULTS

Demographics

A total of 236 responses were received, for a response rate of 37%. Survey respondents' demographic information is summarized in Table 1. The demographic profile of our sample was generally similar to that of the entire student body, as reflected in archival data provided by the institution. There were no clear differences in response rate by gender (52% vs. 48% male survey respondents vs. institutional enrollment, respectively). Since age was assessed categorically in our survey (to preserve confidentiality), it is not possible to definitively determine whether our sample and the general student population differed by age, but our sample may have been slightly younger than the student population as a whole. The average age for a student during that time frame (across years

Table 1 Demographics of Survey Respondents

Demographics of Survey Respondents			
Age, years		Number	Percentage
	≤24	65	27.7%
	25–29	124	52.8%
	30–34	33	14.0%
	≥35	13	5.5%
Gender	Female	109	46.6%
	Male	113	48.3%
	Other/prefer not to respond	12	5.1%
Current year of medical school			
	First year	61	25.8%
	Second year	73	30.9%
	Third year	56	23.7%
	Fourth Year	40	16.9%
	Did not respond	6	2.5%
Educational level			
	Bachelor's degree	214	91.5%
	Master's degree (including MPH)	32	13.7%
	Doctoral degree	5	2.1%

and accounting for different class sizes) was 30 years, suggesting that the average student at the school was older than approximately 80% of our respondents at the time the study was conducted.

Student Beliefs About Medical Aspects of Marijuana

Students generally believed that marijuana could play a role in the treatment of the indications approved in the Colorado MMJ program as of 2016 (Fig. 1). When asked specifically, only a minority of respondents expressed belief that marijuana possessed significant benefits to physical health (49%) and mental health (37%), and a majority expressed concern that marijuana could cause physical and mental harm (68% and 77%, respectively). A majority also indicated a belief that marijuana could be addictive (88%; Table 2).

Figure 1 Indications for which medical students believe marijuana can play a role in medical treatment. These are the eight approved conditions for which physicians can formally recommend marijuana in the State of Colorado.

The overall acceptability of MMJ for treatment of medical conditions did not differ according to age group or gender. Acceptability of MMJ for treatment was related to whether students had lived in Colorado prior to medical school ($t(212) = 2.73$, $p < 0.001$), with those who had not lived in Colorado ($n = 59$, $M = 35.8/48$) scoring MMJ as marginally more acceptable than students who lived in Colorado before starting school ($n = 155$, $M = 32.1/48$). However, students who reported any previous marijuana use ($n = 127$, $M = 35.8/48$) believed MMJ to be more acceptable than those who had never used marijuana ($n = 84$, $M = 28.8/48$; $p < 0.001$). General levels of belief that marijuana holds medical benefits and risk did not differ according to students' gender, age, or whether they had lived in Colorado prior to medical school. When compared to students who had reported never using marijuana, students who had used marijuana reported a greater belief in medical benefits ($n = 137$, $M = 17.44/30$ to $n = 90$, $M = 14.38/30$; $p < 0.001$) and a lower belief in medical risks associated with marijuana use ($M = 12.56/18$ to $M = 13.81/18$; $p < 0.001$; Table 3).

Student Opinions on Marijuana Policy

Of the students surveyed, 64% expressed the belief that marijuana should be legalized for recreational use, with 72% supporting reclassification of marijuana so that it is no longer a Schedule I substance. Broad support for marijuana legal reform was variable (ranging from 3–18 on a scale of 18; Table 2), and was not associated with age, gender, or having lived in Colorado prior to school. Support for legal changes was related to whether the person had used marijuana ($n = 138$, $M = 13.9$) compared to those who had not used marijuana ($n = 91$, $M = 10.8$; Table 3).

Students also strongly supported eliminating legal/criminal penalties or disciplinary action against the medical licenses of physicians who recommend marijuana to patients (94% and 88%, respectively; Table 2). Differences in support for these adverse consequences for physicians also did not differ according to gender, age, or whether students lived in Colorado prior to medical school, but did according to whether students had used marijuana in the past ($n = 137$, $M = 3.68/12$ for those who had; $n = 92$, $M = 4.89$ for those who had not; Table 3). However, only a minority would recommend marijuana to a patient under current law (29%), or if it were legally available (45%; Table 2).

DISCUSSION

The role of MMJ in the treatment of patients with a wide spectrum of medical conditions will continue to be redefined as the social, political, and legal environments evolve. Over 55% of the United States population lives in a state with reformed marijuana laws.² In Colorado, there were approximately 25 times as many individuals on the Medical Marijuana Registry¹ as there were persons living with HIV/AIDS⁹ at the time this survey was conducted. To the best of our knowledge, ours is the first study to address medical student attitudes and beliefs about marijuana, and the first to

Table 2 Properties of Six Subscales Related to Marijuana Beliefs of Medical Students

Subscale		M (SD)		
Support for legal reform ($\alpha = 0.859$)		12.7 (4.2)	Item/total <i>r</i>	% Agree
Items	The FDA should reclassify marijuana so that it is no longer a Schedule I drug/substance.	4.4 (1.6)	0.87	72.5
	Marijuana should be legalized for recreational use.	3.9 (1.6)	0.90	64.4
	Federal and state governments should abolish criminal penalties relating to consumption or possession of cannabis.	4.4 (1.5)	0.87	74.9
Subscale		M (SD)		
Belief that marijuana has medical benefits ($\alpha = 0.898$)		16.3 (5.5)	Item/total <i>r</i>	% Agree
Items	If marijuana were legally available, I would recommend the use of marijuana to a patient.	3.2 (1.3)	0.90	85.7
	Under current law and practice guidelines, I would recommend the use of marijuana to a patient.	2.7 (1.3)	0.85	86.8
	There are significant physical health benefits to using marijuana.	3.4 (1.3)	0.83	65.5
	There are significant mental health benefits to using marijuana.	2.9 (1.4)	0.82	36.6
	Physicians should recommend marijuana as a medical therapy.	4.2 (1.3)	0.83	73.9
Subscale		M (SD)		
Belief that marijuana has medical risks ($\alpha = 0.790$)		13.0 (2.9)	Item/total <i>r</i>	% Agree
Items	Using marijuana poses serious physical health risks.	3.9 (1.2)	0.76	68.4
	Using marijuana poses serious mental health risks.	4.3 (1.2)	0.87	77.0
	Marijuana can be addictive.	4.8 (1.0)	0.88	88.1
Subscale		M (SD)		
Support MMJ training and research ($\alpha = 0.813$)		20.2 (3.3)	Item/Total <i>r</i>	% agree
Items	Training about medical marijuana should be incorporated into medical school curricula.	4.7 (1.1)	0.90	91.1
	Training about medical marijuana should be incorporated into residency curricula.	4.6 (1.1)	0.90	88.6
	Physicians should have formal training about medical marijuana prior to recommending it to patients.	5.5 (0.87)	0.70	97.5
	Additional research regarding medical use of marijuana should be encouraged.	5.4 (0.91)	0.75	96.6
Subscale		M (SD)		
Support adverse consequences for physicians who recommend MMJ ($\alpha = 0.909$)		4.2 (2.0)	Item/total <i>r</i>	% Agree
Items	A physician who recommends medical marijuana to a patient should be subject to legal and/or criminal penalties.	1.9 (1.0)	0.95	6.4
	A physician who recommends medical marijuana to a patient should be subject to action against his/her medical license.	2.2 (1.1)	0.96	11.9

be reported following passage of legal recreational marijuana in Colorado.

Student Attitudes and Beliefs

Overall, Colorado medical students had strikingly positive attitudes and beliefs toward marijuana. They viewed the legalization of marijuana, medicinal or otherwise, in a favorable manner, and defended the rights of the physicians to recommend marijuana to patients. Students generally felt that MMJ was acceptable in the treatment of indications approved by the Colorado Medical Marijuana Registry, and nearly half felt that marijuana had significant health benefits. In contrast, pain and cancer were the only indication for which a majority of Colorado family physicians had recommended marijuana, and only 27% of Colorado family physicians felt it had significant physical health benefits.⁷ Student attitudes are more similar to those expressed in a 1991 survey of the American Society of Clinical Oncologists (ASCO), which showed that 48% of respondents would prescribe marijuana if it were legally available.⁶

However, students were nearly unanimous in calling for further research into the medical usefulness of marijuana, a stance shared with the American College of Physicians, the American Medical Association's Medical Student

Section, and the Institute of Medicine.^{10–12} Improving physicians' and students' knowledge will require a stronger evidence base, as well as increased training opportunities at the undergraduate, graduate, and continuing medical education levels.⁷ Despite strong support for marijuana legal reform, students expressed hesitancy to recommend it themselves, which suggests that medical students may not believe that there is enough data to safely recommend its use to patients and/or may not feel sufficiently trained to prescribe it.

It is possible that non-medical reasons factor into medical students' favorable views of marijuana legal reform. Groups and individuals favor marijuana legal reform for many reasons, including costs related to prohibition enforcement, legal proceedings, and incarceration, as well the economic and non-economic impact that these have on individuals, families, and society. Previously published studies of physicians have suggested that characteristics including being less religious and political liberalism are associated with greater support for legalizing marijuana,⁵ and support for legalization was associated with "non-moralism" and "permissiveness."¹³ Future research should explore whether medical students favor medical legal reform for non-medical reasons, while simultaneously having medically based apprehension for recommending it to patients.

Table 3 Demographic Associations with Marijuana Beliefs

	Range (highest possible)	Male, M (SD) (n = 113)	Female, M (SD) (n = 109)	p	Age <24, M (SD) (n = 65)	Age 25-29, M (SD) (n = 124)	Age 30+, M (SD) (n = 47)	p*	Have NOT used MJ, M (SD)† (n = 92)	Have used MJ, M (SD)‡ (n = 138)	p	Did NOT live in CO, M (SD) (n = 63)	Lived in CO, M (SD) (n = 173)	p
Acceptability of MMJ for treatment of approved conditions	8-40 (48)	33.5 (9.1)	32.7 (8.8)	0.542	32.7 (8.5)	33.2 (8.5)	33.1 (11.0)	0.934	28.8 (9.3)	35.7 (7.69)	0.000§	32.0 (9.4)	35.8 (7.6)	0.007§
Believe MJ has medical benefits	5-30 (30)	16.6 (5.7)	16.0 (5.3)	0.452	16.4 (5.6)	16.0 (5.2)	17.2 (6.1)	0.451	14.4 (4.9)	17.4 (5.6)	0.000§	9.3 (3.5)	9.9 (3.4)	0.233
Believe MJ has medical risks	5-18 (18)	12.9 (2.9)	13.1 (2.9)	0.628	12.5 (3.1)	13.3 (2.6)	13.0 (3.3)	0.190	13.8 (2.7)	12.6 (3.0)	0.001§	8.4 (2.2)	7.9 (2.3)	0.084
Support legal reform	3-18 (18)	13.2 (4.1)	12.0 (4.1)	0.024	12.8 (4.5)	12.5 (3.9)	13.0 (4.2)	0.763	10.8 (4.1)	13.9 (3.7)	0.000§	12.5 (4.2)	13.4 (4.0)	0.125
Support MMJ training & research	4-24 (24)	20.1 (2.9)	20.7 (3.0)	0.082	20.3 (3.3)	20.4 (3.0)	19.7 (4.0)	0.470	19.6 (3.4)	20.7 (3.1)	0.016	20.1 (3.4)	20.6 (2.8)	0.275
Support adverse consequences for physicians who recommend MMJ	2-12 (12)	4.1 (2.2)	4.2 (1.9)	0.954	4.0 (1.8)	4.3 (2.1)	3.9 (2.3)	0.371	4.9 (2.3)	3.7 (1.7)	0.000§	4.4 (2.1)	3.6 (1.7)	0.009

*One-way ANOVA for between-group differences; no contrasts met Bonferroni-adjusted p

†Respondents who reported having never used marijuana in their lifetime

‡Respondents who reported having used marijuana at any point in their lifetime

§Independent-samples t test significant at Bonferroni-adjusted p < 0.008

The findings related to prior personal experience with marijuana use are consistent with prior studies showing that individuals with a history of substance use, including marijuana, perceive a lower risk of adverse effects related to use than those who have not.¹⁴ Hypothesized explanations for these findings include individuals' desire to reconcile past behavior with their perceived identity, perceiving one's own risks with unrealistic optimism,¹⁵⁻¹⁷ or using one's own lack of negative repercussions to support a belief that risks associated with marijuana use have been overstated historically. It is possible that medical students employ these strategies when assessing the risks and benefits of medical marijuana. These results are also consistent with a previous study of physicians which showed that prior drug use was associated with a favorable opinion of marijuana legalization.¹³

LIMITATIONS

The primary limitation of our study is our response rate of 38%. However, medical students are a relatively homogeneous group,¹⁸ and prior studies have shown relatively low response rates in surveys of medical professionals.¹⁹ We are reassured by the similarity of our reported marijuana use to that of a study published in JAMA²⁰ describing drug use in American medical students, and our response rate is similar to those of the ASCO and Colorado Academy of Family Physicians studies that were used in our study's survey development.^{6,7} Demographic comparison between responders and non-responders suggests that our respondents were similar in gender but may have been slightly younger than the overall student body, though statistical comparison is limited. Additionally, subgroup analyses were performed in an exploratory fashion and could not be adjusted for confounding factors. However, these results are consistent with prior studies on physician attitudes with regard to marijuana use.¹³ While our survey had strong face validity and internal reliability, future studies will be necessary to further assess survey validity and to determine which factors are most important in measuring beliefs regarding marijuana among medical students. The single-site design may imply that findings are primarily applicable to University of Colorado students. However, this survey captured a unique moment in the years following the legalization of both medical and recreational marijuana, and as such represents the first group of medical students and professionals encountering marijuana use of this scale in a medical setting.

FUTURE DIRECTIONS

As more states begin liberalizing marijuana laws, medical schools in other states will experience challenges similar to those seen in Colorado. Since physicians are not the

only providers confronted by patient marijuana use, surveying other health professionals would have additional merit; however, at the time that this study was completed, physicians were the only level of healthcare providers in Colorado authorized to give patients formal medical marijuana recommendations through the state registry.

CONCLUSIONS

The topic of marijuana brings up numerous social, cultural, legal, and medical concerns in a way that few other topics do, and much of this seems to occur outside of a medical context. Large numbers of Americans believe that marijuana has medicinal benefit, and many have taken steps to incorporate marijuana into their medical care, regardless of legal consequences. As the general trend toward legalization of marijuana continues, it is the responsibility of the medical field to understand the implications that this substance may have on the people and populations affected. Our study is the first to demonstrate the opinions of medical students on the topic of marijuana, helping to predict future physician attitudes surrounding this culturally charged topic.

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Compliance with Ethical Standards:

Conflict of Interest: *The authors declare that they do not have a conflict of interest. No external funding was used for this project.*

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