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## Medical Marijuana Education for Medical Students

Patrick McGuire

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### **Abstract:**

As the nationwide discourse on medical marijuana evolves, with 28 out of 50 states approving its use, University of Massachusetts Medical School graduates will need to be prepared to discuss medical marijuana (MMJ) with their patients. There is currently no formal medical school education on MMJ. This project set out to understand the curriculum gap and provide a learning session to interested students. The presentation was created using research done by the author during the first three years of medical school, including visits to private MMJ clinics. Utilizing a pre/post-session online assessment of a group of twenty-six students, we found that student knowledge about Massachusetts' MMJ law improved by 29%, following a ninety-minute session. In addition, self-assessed confidence in negotiating clinical scenarios involving marijuana improved by 34%. These improvements were statistically significant, with p-values of 0.0033 and  $9.5 \times 10^{-16}$  respectively. These findings support the formal addition of a sixty-to ninety-minute session focusing on MMJ to the UMMS curriculum.

### **Introduction:**

Medical marijuana gained popularity in the United States beginning in 1996, when California approved its use for conditions including glaucoma, persistent muscle spasms, and chronic pain. Since that time, twenty-eight states and Washington, DC have voted to permit the medical use of marijuana.<sup>1</sup> Massachusetts's voters approved a medical marijuana law in 2012, enabling citizens to use marijuana for any one of the following "debilitating medical conditions": Cancer, glaucoma, HIV/AIDS, hepatitis C, amyotrophic lateral sclerosis (ALS), Crohn's disease, Parkinson's disease, multiple sclerosis or "other conditions as determined in writing by a qualifying patient's physician."<sup>2</sup> At that time, the state's Department of Public Health (DPH) began the process of issuing licenses for up to thirty-five medical marijuana dispensaries. Although it took several years for the DPH to streamline this dispensary licensing process, physicians began certifying patients for the use of medical marijuana immediately. Since 2012, physicians have certified over 38,000 patients in the use of medical marijuana (MMJ).<sup>3</sup> As of November 2016, the DPH has licensed dispensaries in eight cities and towns: Salem, Ayer, Quincy, Brockton, Brookline, Boston, Lowell and Northampton.

In addition to extensive acceptance of MMJ, our nation is experiencing a relaxation in its attitude towards cannabis in general. Most recently, California, Massachusetts, and Nevada approved the recreational use of marijuana in November 2016, making seven total states and Washington, DC that now permit recreational marijuana.<sup>4</sup> These results join the introduction of the federal CARERS Act in March of 2015, co-sponsored by New Jersey Democrat Cory Booker, New York Democrat Kristen Gillibrand, and Kentucky Republican Paul Rand. If passed, this law would make sweeping alterations to

federal marijuana regulations, including banking changes that would prevent both medical and recreational marijuana from being cash-only businesses.<sup>5,6</sup>

Despite this loosening in America's restrictions on marijuana use and the nationwide prevalence of MMJ, the medical community at large has yet to reach a consensus on the appropriate medical uses of marijuana. The FDA has approved two cannabinoid medications – nabilone and dronabinol – for the treatment of nausea and vomiting associated with chemotherapy and cachexia associated with AIDS, respectively. Cannabis itself, though, remains a Schedule I substance according to the DEA, meaning it has “no currently accepted medical use.”<sup>7</sup> The record of randomized trials demonstrates the efficacy of MMJ for certain indications approved by Massachusetts' 2012 law, but not others. The most recent analyses of randomized clinical trials do not support the use of MMJ for symptoms related to Parkinson's disease, Crohn's disease, or ALS.<sup>8</sup> Multiple studies have shown evidence supporting the efficacy of MMJ in chronic pain and neuropathic pain<sup>9</sup>, but these are not named as approved conditions in the 2012 law and would fall under the “other conditions as determined in writing by a qualifying patient's physician” criterion.

Much of the debate surrounding MMJ is limited by the lack of high-quality research into the drug. The DEA's designation as a Schedule I substance makes research into MMJ more cumbersome than with substances such as cocaine, methamphetamine, and fentanyl, which are designated as Schedule II.<sup>7</sup> Additionally, cannabis is a source of over sixty-six distinct cannabinoids – compounds with binding activity at one of the two cannabinoid receptors.<sup>10</sup> Among these cannabinoids,  $\Delta^9$ -tetrahydrocannabinol (THC) and cannabidiol (CBD) are the best studied, and it is believed THC is responsible for euphoria and possibly psychosis, while CBD is responsible for antianxiety effects.<sup>8</sup> There is still a great deal to be learned about the physiologic effects of marijuana, including strains with highly variable concentrations of THC and CBD, despite the fact that it is already approved for medical use in over half of American states. According to the National Institute on Drug Abuse, the average THC concentration in recreational MJ rose to nearly 12% in 2012, from below 4% in 1995.<sup>11</sup> Meanwhile, in November 2016, one Massachusetts dispensary's website listed a strain of MMJ with a THC concentration of 24.6% along with one “shatter” concentrate with 85.6% THC.<sup>12</sup> In August 2016, the DEA signaled a shift in the future of MMJ research by announcing it would expand the number of DEA-registered “marijuana manufacturers” to meet the increasing demand in quantity and diversity of MMJ for FDA-approved research.<sup>13</sup> Notwithstanding potential future improvements in MMJ research, the current lack of standardized dosages, concentrations, or a purification processes – as is the standard in traditionally FDA-approved medications – complicates research into MMJ.

Graduates of the University of Massachusetts Medical School (UMMS) will be entering a life of practice in which they will face questions from patients regarding MMJ; Massachusetts' 2012 law requires physician certification for MMJ use. However, there is no current place in the medical school curriculum exploring the legal issues, evidence, or clinical considerations for MMJ. This project set out to understand medical student attitudes toward MMJ and prepare medical students for practice in a world where MMJ is

commonplace with a learning module on the medical use of marijuana. Specifically, we wondered if a sixty- to ninety-minute learning session could improve students' knowledge level regarding Massachusetts's law and randomized-controlled evidence (RCT) covering MMJ, as well as students' confidence in approaching clinical MMJ scenarios. Twenty-six students participated in an interactive session focusing on the current legal status of marijuana, the evidence surrounding the medical use of marijuana, and the first-hand experience of physicians and patients.

### **Methods:**

The learning session took place in November 2016 with students participating in UMMS's student-run Substance Abuse Elective; students received credit toward their completion of the elective for participation in the session. All medical students were made aware of the learning session through a school-wide email and within a weekly bulletin organized by the Student Body Committee. Substance Abuse Elective participants were also independently notified by the elective's leadership. Respondents to these communications were grouped into an email list and sent a reminder to attend the session one day prior to the event.

Evaluation of the session was done through the use of anonymous pre/post-assessments completed via an online Google Form submission (Figure 2). All participants agreed to complete this anonymous assessment prior to participation in the learning session. Participating students were provided a link to the survey immediately before beginning the didactic portion of the session. Students were again provided with this link following the session. Because not all students were able to stay to complete the post-survey, participants were sent an email one day after the session asking them to complete the post-survey if they had not yet done so.

The assessment was presented in an identical format both before and after the session. Students did not have access to their previous answers when completing the post-survey. We chose to assess the session by determining student changes in two broad domains: factual knowledge of MMJ medical evidence and law, as well as self-assessed confidence and attitude towards MMJ. The goals of the first domain were to understand students' baseline level of knowledge about MMJ and to test if this one-time learning session was able to improve student knowledge. Similarly, the goals of the second domain were to understand students' baseline levels of self-assessed confidence and attitude towards MMJ, as well as how these parameters changed after the session. We chose to use a Likert scale of 1-5 to assess confidence and attitude because it is a widely used method of gathering student feedback in medical education, and is a method wherein the pre/post data may be compared using a parametric test such as two-tailed t-test analysis.<sup>14</sup> The specific questions asked in this section were created together with advisor Jeffrey Baxter based on prior experiences in medical education.

In the first part of the assessment, students were asked to respond to two prompts regarding evidence for and laws about MMJ use with a choice of true or false for twelve different medical conditions. Six of the listed indications (multiple sclerosis, Parkinson

disease, glaucoma, cancer, hepatitis C, and HIV/AIDS) can make patients eligible for MMJ in Massachusetts and the other six indications (Alzheimer disease, epilepsy, Tourette syndrome, PTSD, severe chronic pain, and terminal illness with life expectancy less than one year) are approved indications for MMJ in other states. As discussed in the Introduction, the following conditions were considered to have RCT evidence supporting treatment with MMJ and presented as such: multiple sclerosis, epilepsy, cancer, severe chronic pain, and HIV/AIDS. Thus, there were six options with a correct answer of “true” in response to the prompt, “A debilitating form of this condition makes a patient eligible for medical marijuana according to Massachusetts' 2012 law,” and there were five options with a correct answer of “true” in response to the prompt, “There is randomized-controlled trial evidence supporting medical marijuana use for this condition.”

Answers to Question 3 of Figure 2 were analyzed by calculating the percentage of correct responses for each of the twelve medical conditions in the RCT evidence and MA state law columns for the pre/post-assessment responses. The mean percentages of correct responses for the pre/post-assessments were compared using a two-tailed t-test analysis with an alpha value of 0.05.

In the second part of the assessment, students used a Likert rating scale to evaluate their personal confidence in clinical and legal matters surrounding MMJ, as well as their personal attitudes toward MMJ. On these scales, 1 indicated strong disagreement and 5 indicated strong agreement with statements beginning with the phrases, “I am confident...”, “I support...”, or “I believe...”.

These data were statistically analyzed by pooling data from two groups of questions assessing self-confidence. The pre and post values for parts a, b, and c of Question 4 in Figure 3 were pooled and collectively compared using a two-tailed t-test analysis with an alpha value of 0.05. All of these questions focused on self-confidence managing clinical scenarios involving MMJ. Similarly, parts d and e of Question 4 in Figure 3 were pooled and collectively compared. Both of these questions focus on self-confidence in understanding the legal status of MMJ. This method of pooling multiple Likert-scale questions to create a larger sample size is supported by Sullivan and Artino in assessing topics such as self-confidence.<sup>14</sup> The mean results from the final three questions were not pooled and the two-tailed t-test analysis was conducted on the mean response to each individual question.

## **Results:**

Fifty-six students replied to the initial round of communication stating intent to attend the learning session and consent to complete the pre/post-assessments. Ultimately, twenty-six medical students completed the pre-session survey. This group consisted of seventeen members of the class of 2020, seven members of the class of 2019, and two members of the class of 2017. Fifteen students completed the post-session survey, or 58% of the initial participants. Post-session follow-up was solicited as mentioned in the Methods section.

Figure 3 contains columns showing the percentage of correct responses to the RCT and MA state law questions, both before and after the session. For analyzing RCT evidence, the average correct response rate across all twelve diseases was 58% prior to the learning session. After the session, overall average correct response rate rose to 65% in the post-session assessments. This increase did not represent a statistically significant change. The data regarding knowledge of MA state law, also presented in Figure 3, supported a statistically significant improvement as a result of the learning session. Prior to the session, mean correct response rate across the 12 diseases was 48%. After the session, mean correct response rate rose to 77%. The p-value for this change was 0.0033. Thus, the learning session improved students' ability to identify the conditions for which MMJ is approved by Massachusetts state law.

Figure 4 contains the data showing mean strength of agreement on Likert scales with the statements presented in the second portion of the pre/post-survey. In these scales, 1 represented strong disagreement and 5 represented strong agreement. The statistical analysis of pooled responses to statements a, b, and c support a statistically significant increase in mean self-confidence, with the mean rising from 1.9 to 3.6. Participant self-confidence in knowledge about the legal status of MMJ also increased from a mean of 1.6 to 3.6. This result was statistically significant, with an extremely small p-value of  $1.8 \times 10^{-16}$ . Together, these results indicate student self-confidence in matters related to MMJ truly did increase as a result of the learning session.

For the final three statements using the Likert scale, we found increases in level of support for MMJ, support for inclusion of MMJ material in the UMMS curriculum, and plans to include MMJ in future practice. These changes from before to after the session were not statistically significant. Of note, these questions had much smaller sample sizes because they were not grouped together for analysis. This means larger changes in the means would be needed for the results to be statistically significant.

### **Discussion:**

The results of this study support the inclusion of a brief, formal MMJ curriculum in the general UMMS curriculum. We have documented UMMS students' desire to learn more about the medical role of marijuana and shown there is a gap in students' current knowledge. Not only are students not aware of the exact laws governing MMJ, they are not confident in their ability to counsel patients regarding the health risks and benefits of marijuana. This is at a time when Massachusetts' amount of MMJ certifications grows monthly and voters have approved recreational marijuana. By participating in this learning session, student factual knowledge and self-confidence both improved. This improvement was despite an audio/visual difficulty that prevented showing videos summarizing the biological effects of cannabis and evidence regarding its medical use.

This study faced several limitations typical of an informal, survey-driven curriculum inquiry. There is an overall small sample size that may have limited our ability to find significant changes in the pre/post data. Selection bias also likely played a role throughout the recruitment of students to attend the learning session. Attendance was

voluntary, and although most students received credit as substance-abuse elective participants, participation in that elective is itself voluntary and subject to self-selection. Together, these points mean that session attendees were not a random sample of medical students. These limitations are predictable challenges that arise from an attempt to evaluate the UMMS curriculum as was done in this study.

There are numerous options available to UMMS for how to use the findings presented in this study. The simplest follow-up would be a required survey of all medical students and faculty. This survey would evaluate openness to inclusion of MMJ in the formal curriculum and ideas regarding where it may fit best. Recent curriculum changes to address the opioid crisis in Massachusetts raise the question of a need for more comprehensive mandated addiction curriculum in general.<sup>15</sup> Such a program could be added in an integrated format or modeled after the currently existing Interstitial Days. In either case, this would be an excellent venue for including a discussion of MMJ, in particular due to intriguing findings negatively correlating state MMJ use with opioid overdose deaths.<sup>16</sup> Another option for implementing these findings would be creation of a video series for medical students similar to those created by the University of Washington Alcohol and Drug Abuse Institute.<sup>17</sup> These videos provide education on the use of cannabis to treat chronic pain, are freely available online, and can be used to obtain Continuing Medical Education (CME) credits. The Massachusetts Medical Society (MMS) also provides recordings of lectures focused on MMJ via its online CME system.<sup>18</sup> These videos are freely available to medical students with MMS membership.

By formally including MMJ in its curriculum, UMMS would be seizing an opportunity to ensure that scientific evidence is well represented in the public discourse on marijuana. The history of state-by-state approval of medical marijuana in the absence of medical consensus on its proper use has created confusion over the facts of marijuana nationwide. UMMS has a responsibility to clarify marijuana's medical status for its students, and by extension the broader public. More importantly, UMMS has an opportunity to shape the future of MMJ research by exposing its future graduates to an area of medicine that is certain to experience significant changes in the coming years. In keeping with UMMS' strong tradition of student-informed curriculum changes, another student's Capstone Project would be an excellent method of introducing this curriculum addition.

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## Appendix:

Figure 1: This can be found in the accompanying “MMJ Presentation.pdf” file. References are documented at the bottom of each slide and compiled on slide 46. The presentation is structured around a clinical case of a patient seeking certification for MMJ. The major sections are: the biological of marijuana, the legal status of marijuana in both Massachusetts and America, a review of the medical evidence on marijuana, and important clinical considerations including risks of marijuana use.



Figure 2: The following questions were asked via an online Google Form, which can be found at this link: <https://goo.gl/forms/UnpkFPWgVaiR91s22>

Pre/Post Session Assessment

1. Please circle **PRE** or **POST** based on when you completed this assessment.
2. Please circle your class year:    2017    2018    2019    2020
3. Please complete the following table. Circle either true or false in both categories: evidence for medical marijuana and approved indication by Massachusetts' 2012 law.

Condition	There is randomized-controlled trial evidence supporting medical marijuana use for this condition:		A debilitating form of this condition makes a patient eligible for medical marijuana according to Massachusetts' 2012 law:	
	True	False	True	False
Multiple Sclerosis	True	False	True	False
Parkinson Disease	True	False	True	False
Alzheimer Disease	True	False	True	False
Epilepsy	True	False	True	False
Tourette Syndrome	True	False	True	False
Post-traumatic Stress Disorder	True	False	True	False
Glaucoma	True	False	True	False
Cancer	True	False	True	False
Hepatitis C	True	False	True	False
Severe chronic pain	True	False	True	False
HIV/AIDS	True	False	True	False
Terminal illness with life expectancy below 1 year	True	False	True	False

4. Please respond to the following statements about medical marijuana (MMJ) by indicating how strongly you agree with an "X" in the corresponding box:

a. I am confident in my ability to identify indications for MMJ in a clinical setting.

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

b. I am confident in my ability to identify *contraindications* for MMJ in a clinical setting.

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

c. I am confident in my ability to counsel a patient on the benefits and drawbacks of MMJ.

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

d. I am confident in my ability to counsel a patient on the differences between federal law and Massachusetts' state law regarding MMJ use.

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

e. I am confident I have an understanding of how to navigate the system for certifying a patient for MMJ in Massachusetts.

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

f. I support the use of MMJ.

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

g. I plan to include MMJ in my future medical practice.

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

h. I have had clinical or academic exposure to MMJ during medical school.

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

i. I believe the UMMS curriculum should include more material focusing on MMJ

Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly

Figure 3: This table shows the percentage of correct responses, in decimal form, for each of the conditions assessed in Question 3 of Figure 2, both before and after the session. The p-values were obtained using a two-tailed t-test analysis with an alpha value of 0.05.

	Randomized-controlled trial evidence supporting effectiveness of medical marijuana		Approved in Massachusetts by 2012 law	
	Pre-assessment <b>Correct Percentage</b> (n=26)	Post-assessment <b>Correct Percentage</b> (n=15)	Pre-assessment <b>Correct Percentage</b> (n=26)	Post-assessment <b>Correct Percentage</b> (n=15)
Multiple Sclerosis	0.46	0.60	0.62	0.8
Hepatitis C	0.85	0.47	0.35	0.93
Parkinson Disease	0.61	0.66	0.62	1.0
Alzheimer Disease	0.81	0.73	0.62	0.67
Cancer	0.69	0.47	0.88	1.0
Glaucoma	0.53	0.60	0.69	1.0
Post-traumatic Stress Disorder	0.35	0.87	0.27	0.80
Tourette Syndrome	0.50	0.87	0.54	0.73
Epilepsy	0.69	0.53	0.23	0.47
Terminal illness with life expectancy below 1 year	0.38	0.80	0.23	0.53
HIV/AIDS	0.31	0.60	0.5	0.93
Severe chronic pain	0.77	0.60	0.19	0.40
<b>Mean Correct Percentage</b>	0.58	0.65	0.48	0.77
<b>Standard Deviation</b>	0.18	0.14	0.22	0.21
<b>Variance</b>	0.034	0.020	0.049	0.046
<b>p-value</b>	0.30		0.0033*	

\* Indicates statistical significance.

Figure 4: This table shows the mean numerical response (scale of 1-5) for each of the questions asked in Question 4 of Figure 2, along with the statistical analysis using two-tailed t-test analysis with an alpha value of 0.05 for two pooled groups of questions.

	Mean strength of agreement: Pre-assessment (n=26)	Mean strength of agreement: Post-assessment (n=15)	p-value of Mean Comparison
I am confident in my ability to identify indications for MMJ in a clinical setting.	1.8	3.7	9.5x10 <sup>-16</sup> *
I am confident in my ability to identify contraindications for MMJ in a clinical setting.	1.8	3.6	
I am confident in my ability to counsel a patient on the benefits and drawbacks of MMJ.	2.1	3.4	
<b>Pooled Mean</b>	1.9	3.6	
<b>Pooled SD</b>	1.0	1.0	
<b>Pooled Variance</b>	0.90	0.80	
I am confident in my ability to counsel a patient on the differences between federal law and Massachusetts' state law regarding MMJ use.	1.7	3.8	1.8x10 <sup>-16</sup> *
I am confident I have an understanding of how to navigate the system for certifying a patient for MMJ in Massachusetts.	1.4	3.5	
<b>Pooled Mean</b>	1.6	3.6	
<b>Pooled SD</b>	0.78	0.81	
<b>Pooled Variance</b>	0.60	0.65	
I support the use of MMJ.	3.3	3.9	
I plan to include MMJ in my future medical practice.	2.9	3.4	0.086

I believe the UMMS curriculum should include more material focusing on MMJ.	3.4	3.7	0.34
I have had clinical or academic exposure to MMJ during medical school.	1.4	Not recorded	

\* Indicates statistical significance.