

Cannabis Education in United States Pharmacy Colleges and Schools

Running Title: Cannabis Education in U.S. Pharmacy Schools

Daniel J. Kruger, Ph.D.,^{1,2}, Jessica S. Kruger, Ph.D.,² Edward M. Bednarczyk, Pharm.D.,^{3,4}

William Allan Prescott, Jr., Pharm.D.³

¹ University of Michigan Population Studies Center, Ann Arbor, Michigan.

² University at Buffalo Department of Community Health and Health Behavior, Buffalo, New York.

³ University at Buffalo School of Pharmacy and Pharmaceutical Sciences, Buffalo, New York

⁴ Fellow, American College of Clinical Pharmacy

Corresponding Author:

Daniel J. Kruger, Population Studies Center, University of Michigan, 426 Thompson St., Ann Arbor, MI 48109. Email: kruger@umich.edu

Conflict of interest: The authors declare no conflicts of interest.

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: [10.1002/jac5.1400](https://doi.org/10.1002/jac5.1400)

This article is protected by copyright. All rights reserved.

Abstract

INTRODUCTION: Given the rapid change in legal status and rise in cannabis use within the United States, pharmacists will increasingly require competence in issues related to cannabis, especially for medical use. Pharmacy students and professionals in other health fields report low levels of cannabis knowledge, and medical cannabis users report that their knowledge is mostly from their own experiences and the internet. Several pharmacy organizations have advocated for pharmacists' education on therapeutic and legal issues related to medical cannabis.

OBJECTIVES: To determine the extent to which cannabis and its medical use are covered in the educational curricula of U.S. schools and colleges of pharmacy, plans for future coverage of medical cannabis, and differences by the state-level legal status of cannabis.

METHODS: Pharmacy schools and colleges located within the United States were identified via the Accreditation Council for Pharmacy Education website. A 19-item survey was developed by researchers with experience in curriculum development and pharmaceutical issues related to cannabis. One individual from each school provided detailed information on the inclusion of medical cannabis/marijuana topics in their Doctor of Pharmacy program.

RESULTS: Two-thirds (67%) of programs responded to the survey. Most programs (85.4%) had content on medical cannabis available in their curriculum, 53.1% in their required curriculum, 65.6% in their elective curriculum, and 33.0% in both their required and elective curricula. A small proportion (16.7%) had a stand-alone medical cannabis elective course. Stand-alone electives had the most comprehensive coverage of cannabis topics. General required and elective courses had minor differences in comprehensiveness.

CONCLUSION: Results demonstrate a moderately rapid expansion in cannabis coverage in pharmacy curricula, though coverage of cannabis topics is rarely comprehensive. Additional efforts are needed to integrate cannabis into coursework and experiential learning experiences.

Keywords: pharmacy education, cannabis, marijuana, curriculum

The legal environment for cannabis is changing quickly in the United States, and a rapidly rising number of individuals are using cannabis for medical and recreational purposes.^{1,2} Although cannabis remains a Schedule I drug under the 1970 Federal Controlled Substances Act, 33 states and the District of Columbia have legalized medical cannabis, and 11 states and the District of Columbia have legalized recreational cannabis. The Agriculture Improvement Act of 2018 (“Farm Bill”) allowed for the nationwide sale of cannabidiol (CBD) products manufactured from cannabis containing less than 0.3% tetrahydrocannabinol (THC). THC, CBD, and nabilone-containing products have been approved by the Food and Drug Administration (FDA), and nabiximols is available outside the U.S. The National Academies of Sciences, Engineering, and Medicine has determined that there is conclusive or substantial evidence that cannabis or cannabinoids are effective in the treatment of chronic pain, chemotherapy-induced nausea and vomiting, and multiple sclerosis spasticity, and that there is moderate evidence that cannabis or cannabinoids are effective for treating some sleep disturbances.³

Cannabis is also used to treat many medical conditions where evidence of effectiveness is limited or insufficient. People who use cannabis often rate cannabis more favorably in terms of effectiveness, side effects, safety, addictiveness, availability, and cost compared with prescribed medications.² It has been reported that some patients have stopped taking or reduced their use of prescribed medication in favor of cannabis, and that health care providers may be unaware of patients’ medical cannabis use.^{2, 4, 5}

States establishing medical cannabis programs have faced prominent challenges in implementing comprehensive plans for educating patients, health professionals, and the general public.⁶ Medical cannabis users obtain their cannabis from dispensaries; however, regulations on the content of educational materials are often vague and general, as are the educational materials available in medical cannabis dispensaries.⁶ Even those enthusiastic about the benefits of medical cannabis generally have poor knowledge of cannabinoid concentrations and effective dosages.⁷

One recent survey found that frequent medical cannabis users' knowledge of cannabis was mostly from their own experiences, followed by sources on the internet.⁸ Fewer reported obtaining cannabis information from health care professionals.⁸ This is concerning because cannabis is much more complex than many other psychoactive substances. It contains over 100 cannabinoids, along with terpenes and hundreds of other molecules that may or may not contribute to the beneficial or toxic effects of cannabis (e.g., THC).⁹⁻¹² Adding complexity, different routes of delivery (oral, topical, smoked, or vaped) have distinctive pharmacokinetic profiles, and established dosing is only available for FDA-approved products.^{13,14}

Five states currently have designated pharmacists' roles in the dispensing process, including limiting dispensing or dispensary licenses to pharmacists.¹⁵ The lack of integration between the medical use of cannabis and the mainstream health care system creates several problematic issues, and the integration of medical cannabis into health professional training will help to alleviate these issues. The American Society of Health-System Pharmacists issued a statement in 2011 advocating for pharmacists' continued education on therapeutic and legal issues surrounding medical cannabis.¹⁶ In 2015, a policy committee convened by the American Pharmacists Association recommended health care providers be educated on the clinical efficacy, safety, and management of patients treated with cannabis.¹⁷ The Accreditation Council for Pharmacy Education (ACPE) Standards 2016 Appendix 1 identified Alternative and Complementary Therapies as an item central to a contemporary, high-quality pharmacy education, recommending that this topic be incorporated at an appropriate breadth and depth in the required didactic Doctor of Pharmacy (Pharm.D.) curriculum.¹⁸ Pharmacy students have scored low on knowledge-based cannabis questions and reported not feeling confident to counsel on medical cannabis.¹⁹ A study conducted in 2018 found that 62% of pharmacy schools in the U.S. included cannabis content in their curriculum, and another 23% planned to incorporate cannabis content in the next 12 months.²⁰ Information on the scope of cannabis topics covered in these curricula was limited. The current study was conducted to determine the extent to which

topics related to cannabis and the medical use of cannabis are covered in the educational curricula of U.S. schools and colleges of pharmacy and plans for future coverage of medical cannabis. This includes both the scope of cannabis-related topics covered and the proportion of programs, including cannabis topics in their curriculum. If this reflects the rapidly evolving status of CBD and cannabis in general, curricular integration may be substantially higher than it was even two years ago. The study also examined whether coverage differed by the legal availability of medical cannabis in the college or school's home state, as the previous study reported higher coverage in states where medical cannabis was legalized.²⁰

METHODS

Pharmacy schools and colleges located within the U.S. were identified via the Accreditation Council for Pharmacy Education (ACPE) website. Fully accredited, candidate-status and pre-candidate Pharm.D. programs were eligible for inclusion. Contact emails were obtained from the American Association of Colleges of Pharmacy Curriculum and Substance Abuse special-interest groups' email lists. Emails were sent with a study information sheet and a link to the survey instrument. A reminder email was sent two weeks later. Pharmacy schools and colleges that were not represented in the dataset (i.e., no surveys completed) after the initial recruitment round (including schools and colleges not represented on the email lists) were identified, and the offices of deans, associate deans of academics, and department/division chairs were contacted to identify appropriate respondents for these schools. Identified contacts were sent the study information sheet and a link to the survey instrument, and those who had not completed the survey were sent a reminder two weeks later. The researchers considered representation from 60% of schools to be a viable sample. Data were collected between December 2019 and May 2020.

A 19-question anonymous survey instrument was developed on the Qualtrics online survey platform, with skip patterns and screening questions to reduce respondent burden.

Respondents were asked questions pertaining to the inclusion of coursework on medical cannabis/marijuana in their required and elective curricula, including whether or not a stand-alone elective course entirely focused on medical cannabis is offered. Respondents who responded affirmatively were presented with questions pertaining to the number of contact hours (i.e., hours students spend inside the classroom or viewing didactic content online) of class time used to cover medical cannabis/marijuana and the topics that are covered (Table 2). Those who did not answer affirmatively were asked about their plans to add medical cannabis/marijuana coursework to their required and/or elective curricula.

Respondents were also asked if students at their pharmacy school or college are offered introductory pharmacy practice experiences (IPPE) that provide medical cannabis/marijuana training. Respondents who responded affirmatively were asked if their students are offered IPPEs in medical cannabis/marijuana dispensaries. Parallel questions were asked for advanced pharmacy practice experiences (APPE). The time to complete the survey was estimated to be under 10 minutes.

When multiple individuals from the same institution completed the survey, responses from the individual indicated as the contact person for issues regarding coverage of medical cannabis/marijuana in coursework were used. Other duplications were resolved by deleting incomplete (timed-out before completion) surveys in favor of responses with more comprehensive information provided. Chi-Square tests examined differences in schools' likelihood of required coursework content, elective content, and a stand-alone course on medical cannabis by whether their state had a medical cannabis program (without restrictions on THC content). Pearson Correlations were performed between course content availability and the length of time in which medical cannabis has been legally available in the institutions' states. A one-way ANOVA with Tukey's b post-hoc comparisons examined differences in the comprehensiveness of cannabis topic coverage by type of course.

RESULTS

Ninety-six Pharm.D. programs responded to the survey (67% response rate). The median completion time was 3.75 minutes. The response rate for accredited and candidate-status or pre-candidate programs was 67% (92/135) and 44% (4/9), respectively. Programs, 53% (51) public and 47% (45) private, were based in 41 states, Puerto Rico, and Washington DC. Most programs (64%, n=61) were based in states with legalized medical cannabis, 20% (n=19) of programs were based in states with legalized recreational cannabis, and 33% (n=32) were based in states with restricted medical cannabis (e.g., limits on THC levels). Three programs (3%) were based in states with no form of legalized cannabis. Respondents included faculty members (64.9%), Deans (15.4%), Curriculum Committee Chairs (7.7%), Department Chairs (6.4%), one participant was a Professor Emeritus, and one was a Director of Assessment. Some (20.2%) participants indicated that they were the faculty designated to teach medical cannabis.

Most programs (85.4%, n=82) had some content on medical cannabis available in their curriculum, of whom 53.1% (n=51) included this content in their required curriculum, 65.6% (n=63) included this content in their elective coursework, and 33.0% (n=32) had content included in both their required and elective coursework. For programs that did not currently have content on medical cannabis in their required curriculum, 44.2% indicated plans to add this content: 7.0% planned to do so in the next year, and 37.2% planned to do so in the next two to three years. For programs that did not currently have content on medical cannabis in their elective coursework, 42.4% indicated plans to add this content, 12.1% planned to do so in the next year, and 30.3% planned to do so in the next two to three years. About one-sixth of schools (16.7%) had a stand-alone medical cannabis elective course at their university for students enrolled in their Pharm.D. Program, whether in pharmacy or another school or college. Overall, 5.2% of programs did not educate their students on medical cannabis and expressed no plans of adding this content to their coursework. Five (5%) schools offered IPPEs providing training on medical cannabis/marijuana, and three (3%) offered IPPEs in medical marijuana/cannabis dispensaries. Twelve (13%) schools

offered APPEs providing training on medical cannabis/marijuana, and five (5%) offered APPEs in medical marijuana/cannabis dispensaries.

Programs that included content on medical cannabis in their required curriculum had an average of 2.9 contact hours (standard deviation [SD] = 1.9) of class time (i.e., hours students spend inside the classroom or viewing didactic content online) dedicated to this content.

Programs that included content on medical cannabis in their elective coursework had an average of 10.9 ± 21.1 contact hours of elective class time (i.e., hours students spend inside the classroom or viewing didactic content online) dedicated to this content. As expected, stand-alone electives had the most time devoted to covering cannabis topics (mean = 11.8 ± 3.7 contact hours, $p < 0.001$). Required courses (mean = 7.4 ± 4.0 contact hours) and elective courses (mean = 7.0 ± 5.0 contact hours) did not differ in the overall time of cannabis topic coverage. Stand-alone cannabis electives were more likely to cover 10 of the 13 identified cannabis-related topics as compared with required courses and elective courses that were not focused specifically on cannabis; required courses were more likely to cover one topic than elective courses (see Table 2). Although we did not systematically assess continuing education (CE) or continuing pharmacy education (CPE) coursework, one participant noted plans to add cannabis-related content to their continuing education program.

There were no significant differences in the likelihood of programs having required coursework content ($p = 0.550$), elective coursework content ($p = 0.365$), or a stand-alone elective course on medical cannabis ($p = 0.107$) (all two-tailed), by whether their state had a medical cannabis program without restrictions on THC content. States with medical cannabis programs were two-times more likely to have a stand-alone elective course on medical cannabis (21%) than for non-medical states (9%); however, this difference was not statistically significant with the given sample size. The number of years in which medical cannabis was legal at the state level did not predict whether a school or college had required coursework ($p = 0.952$), elective coursework ($p = 0.446$), or a stand-alone elective course on medical cannabis ($p = 0.689$). States with medical

cannabis programs did not differ in the number of topics covered by their required coursework ($p=0.615$), elective coursework ($p=0.492$), or stand-alone elective course on medical cannabis ($p=0.113$). States where cannabis was legal for recreational use did not differ in the likelihood of having cannabis-related coursework or in the extent of coursework content. Schools located in states with an established role for pharmacists in the dispensing process did not differ in the likelihood of having cannabis-related coursework or in the extent of coursework content, though there was a non-significant trend for schools in these states to include this coursework in their required curriculum (68.8% vs 50.0%).

DISCUSSION

The purpose of this study was to determine the extent to which cannabis and its medical use is covered in the curricula of pharmacy schools and colleges in the U.S. and to explore the plans for future coverage of medical cannabis as a course topic. One recent survey of pharmacy students reported high levels of support for medical cannabis coverage in elective (84%) and required courses in the pharmacy curricula (72%).²⁰ Our study found that more than 80% of Pharm.D. programs included some sort of coverage of the topic in either required or elective courses. Among schools and colleges that did not include information on the medical use of cannabis within their curriculum, nearly half plan to do so within the next few years. When comparing our findings to a previous study conducted during 2018, we found substantially more schools included this content in their curriculum (85% compared with 62%).²⁰ This indicates the expansion of cannabis coverage, addressing the field's evolving nature and current market trends. In contrast to the previous results,²⁰ there was not a significant difference in coverage based on whether states had legalized medical cannabis. This could be due to the increase in coverage, though the higher response rate in the present study could be a contributing factor as well.

Pharmacy students have reported low confidence in their abilities to discuss important aspects of medical cannabis with patients, including pharmacokinetics, drug and disease

interactions, risks and benefits of use, and dosage forms, despite their considerable interest in cannabis-related coursework.²¹ These topics were consistently covered only by stand-alone elective courses (See Table 2). Therefore, it is important also to understand and enhance the scope of coverage for cannabis-related issues. Increased awareness of patients' medical cannabis use may not be beneficial if health care providers do not have the knowledge and ability to address cannabis-related issues as part of a patient's treatment plan. Despite the increase in the proportion of pharmacy programs reporting cannabis coverage in their curricula, only around half of the required and elective coursework (not explicitly focused on cannabis) included important topics such as medical effectiveness, dosing, and drug interactions. As expected, stand-alone elective courses focused on cannabis had far more comprehensive coverage of these topics. However, even when offerings outside the pharmacy school were included, these courses were only available in about one-sixth of schools.

Very few programs offered IPPEs or APPEs in medical cannabis or in cannabis dispensaries. Broader and more in-depth coverage of medical cannabis is needed to meet recommendations by the American Society of Health-System Pharmacists and standards set by the Accreditation Council for Pharmacy Education and to equip students with the tools they need to educate patients on medical cannabis, make recommendations, and address cannabis-related issues. Elective practice experiences, as long as they meet accreditation standards, may be especially helpful to improve students' understanding of the full scope of issues related to medical cannabis and those who use cannabis medically. This may emerge as an area of consultative expertise for practitioners. Minimally, it would equip pharmacists to protect patient health by identifying important areas of drug interactions and toxicity.

Although electives that focus specifically on cannabis would be the most systematic way to implement this into the curriculum, it may not be practical due to limitations in time and even expertise within a school. Schools of pharmacy should consider adding information within standing courses where appropriate that include high-impact learning practices, such as case

studies that include patients that are currently using cannabis alongside other pharmaceuticals.²² Furthermore, interactions with prescribed medications should be covered, for example highlighting case studies such as the interaction between warfarin and cannabis.^{23, 24} In a recent study showing that pharmacy students who attended a brief two-hour lecture on CBD were more confident on the topic, the authors recommended that formal lectures be incorporated into the curriculum.²⁵

This investigation, which focuses on integrating medical cannabis content in the curricula of pharmacy schools, has several limitations. First, not all pharmacy schools responded to the survey. Therefore, this investigation's results did not capture the full scope of this topic across the country. However, a wide variety of states were represented, including those which have and have not legalized medical or recreational cannabis. Secondly, respondents answered the questions to the best of their knowledge. Syllabi and curricular maps were not conducted, and therefore, some details may be missing. This study also did not address the prevalence of CPE on cannabis offered by pharmacy schools. This may represent an important tool for educating practicing pharmacists. Delineation of curricular elements is beyond the scope of this paper; however, elements for inclusion in core curricula would include aspects related to substance abuse (addiction potential, vaping risks, etc.) as well as uses of FDA-approved cannabinoids, adverse effects, pharmacokinetics, and effects on hepatic clearance of other drugs. Other topics, such as emerging uses of cannabis, would likely require elective courses. Given the rapidly evolving knowledge base, such curricular elements would need regular revision.

CONCLUSIONS

This study demonstrates that coverage of cannabis in the pharmacy curricula across schools and colleges in the U.S. has expanded to meet the needs of the practice. However, given the rising use of cannabis within the U.S. and the increase in states legalizing medical and recreational cannabis, greater breadth and depth of coverage is needed to provide pharmacists

with comprehensive knowledge related to medical cannabis, especially for those caring for patient populations where the use of cannabis is becoming more common. Integrating a standardized cannabis curriculum would be valuable, although doing so may pose challenges to schools and colleges of pharmacy as the Pharm.D. curriculum is already rigorous and complex. Experiential learning activities, including medical cannabis-related IPPEs or APPEs, may provide opportunities to develop expertise without reducing the scope of other curricular content. It is promising to see that many schools have plans to continue building this topic into the training students receive. Further investigation should explore how these curricula evolve over time.

REFERENCES

1. Bonn-Miller MO, Boden MT, Bucossi MM, Babson KA. Self-reported cannabis use characteristics, patterns and helpfulness among medical cannabis users. *Am J Drug Alcohol Abuse*. 2014;40(1):23-30.
2. Kruger DJ, Kruger JS. Medical Cannabis Users' Comparisons between Medical Cannabis and Mainstream Medicine. *J Psychoactive Drugs*. 2019;51(1):31-36.
3. National Academies of Sciences, Engineering, and Medicine. *The health effects of cannabis and cannabinoids: The current state of evidence and recommendations for research*. Washington, DC: The National Academies Press, 2017.
4. Reiman A. Cannabis as a substitute for alcohol and other drugs. *Harm Reduct J*. 2009;6:35.
5. Reinerman C, Nunberg H, Lanthier F, Heddleston T. Who are medical marijuana patients? Population characteristics from nine California assessment clinics. *J Psychoactive Drugs*. 2011;43(2):128-135.
6. Lamonica LK, Boeri M, Anderson T. Gaps in medical marijuana policy implementation: Real-time perspectives from marijuana dispensary entrepreneurs, health care professionals and medical marijuana patients. *Drugs (Abingdon Engl)*. 2016;23:422-434.
7. Kruger DJ, Kruger JS, Collins RL. Frequent cannabis users demonstrate low knowledge of cannabinoid content and dosages. *Drugs (Abingdon Engl)*. 2020.
8. Kruger DJ, Kruger JS, Collins RL. Cannabis enthusiasts' knowledge of medical treatment effectiveness and increased risks from cannabis use. *Am J Health Promot*. 2020;34(4):436-439.
9. Colizzi M, Bhattacharyya S. Does Cannabis Composition Matter? Differential Effects of Delta-9-tetrahydrocannabinol and Cannabidiol on Human Cognition. *Curr Addict Rep*. 2017;4(2):62-74.

10. Crippa JA, Zuardi AW, Martín-Santos R, et al. Cannabis and anxiety: a critical review of the evidence. *Hum Psychopharmacol*. 2009;24(7):515-523.
11. Cascini F, Aiello C, Di Tanna G. Increasing delta-9-tetrahydrocannabinol (Δ -9-THC) content in herbal cannabis over time: systematic review and meta-analysis. *Curr Drug Abuse Rev*. 2012;5(1):32-40.
12. Chandra S, Radwan MM, Majumdar CG, Church JC, Freeman TP, ElSohly MA. New trends in cannabis potency in USA and Europe during the last decade (2008-2017). *Eur Arch Psychiatry Clin Neurosci*. 2019;269(1):5-15.
13. Huestis MA. Human cannabinoid pharmacokinetics. *Chem Biodivers*. 2007;4(8):1770-1804.
14. Millar SA, Stone NL, Yates AS, O'Sullivan SE. A systematic review on the pharmacokinetics of cannabidiol in humans. *Front Pharmacol*. 2018;9:1365.
15. National Community Pharmacists Association. State medical marijuana legislation and the pharmacist's role. 2017;August.
16. American Society of Health-System Pharmacists. Medical Marijuana (1101). *ASHP Policy Positions 1982–2019*. <https://www.ashp.org/-/media/assets/policy-guidelines/docs/browse-by-document-type-policy-positions-1982-2017-with-rationales-pdf.ashx>. Accessed 26 September 2019.
17. American Pharmacists Association. Role of the Pharmacist in the Care of Patients Using Cannabis. *2014-2015 APhA Policy Committee Report*. <https://www.pharmacist.com/sites/default/files/files/Role%20of%20the%20Pharmacist%20in%20the%20Care%20of%20Patients%20Using%20Cannabis%20.pdf>. Accessed 16 September 2019.
18. Accreditation Council for Pharmacy Education. *Accreditation standards and key elements for the professional program in pharmacy leading to the Doctor of Pharmacy*

- degree "Standards 2016." <https://www.acpe-accredit.org/pdf/Standards2016FINAL.pdf>. Accessed 26 September 2020.
19. Berlekamp D, Rao PSS, Patton T, Berner J. Surveys of pharmacy students and pharmacy educators regarding medical marijuana. *Curr Pharm Teach Learn*. 2019;11(7):669-677.
 20. Smithburger PL, Zemaitis MA, Meyer SM. Evaluation of medical marijuana topics in the PharmD curriculum: A national survey of schools and colleges of pharmacy. *Curr Pharm Teach Learn*. 2019;11(1):1-9.
 21. Caligiuri FJ, Ulrich EE, Welter KJ. Pharmacy Student Knowledge, Confidence and Attitudes Toward Medical Cannabis and Curricular Coverage. *Am J Pharm Educ*. 2018;82(5):424-432.
 22. Lee J, Thomas SA, Cates DW, McGraw-Senat, CM. Improved learning experience with modified case studies courses in a pharmacy curriculum. *Curr Pharm Teach Learn*. 2020;12(10):1224-1238.
 23. Grayson L, Vines B, Nichol K, Szaflarski JP. UAB CBD Program. An interaction between warfarin and cannabidiol, a case report. *Epilepsy Behav Case Rep*. 2017;9:10-11.
 24. Hsu A, Painter NA. Probable interaction between Warfarin and inhaled and oral administration of cannabis [published online ahead of print, 2019 Jul 18]. *J Pharm Pract*. 2019;897190019854958.
 25. Whitman A, Ostroff M, Crocetta N, Roth O, Ostroff JL. Integration of cannabidiol oil education into a pharmacy therapeutics curriculum. *Curr Pharm Teach Learn*. 2020; 12(12):1424-1430.

Table 1. Sample Characteristics	
<i>Institutional Descriptive</i>	Number (%)
Public	51 (53%)
Private	45 (47%)
<i>State Level Cannabis Legal Status</i>	
Illegal	35 (37%)
Medical	42 (44%)
Medical and Recreational	19 (20%)
<i>Medical Cannabis Coursework</i>	
Required	51 (53%)
Elective	63 (66%)
Stand-alone medical cannabis elective	16 (17%)
IPPE	5 (5%)
APPE	12 (13%)

APPE = advanced pharmacy practice experiences; IPPE = introductory pharmacy practice experiences.

Cannabis Education

Table 2. Cannabis Topics by Type of Coursework

Topic	Required/Core	Elective	Stand-Alone Elective
	No. (%)	No. (%)	No. (%)
Pharmacology of cannabinoids	41 (80 ^a)	43 (68 ^a)	15 (100 ^b)
Dosing	18 (35 ^a)	23 (37 ^a)	14 (93 ^b)
Dosage forms (FDA-approved)	36 (71 ^b)	30 (48 ^a)	13 (87 ^b)
Dosage forms (FDA-not approved)	25 (49 ^a)	30 (48 ^a)	13 (87 ^b)
Routes of administration	29 (57 ^a)	32 (51 ^a)	14 (93 ^b)
Misuse/abuse	30 (59 ^a)	39 (62 ^a)	15 (100 ^b)
Adverse drug reactions/safety	30 (59 ^a)	38 (60 ^a)	15 (100 ^b)
Drug interactions	26 (51 ^a)	27 (43 ^a)	15 (100 ^b)
Medical indications (including off-label)	33 (65 ^a)	37 (59 ^a)	14 (93 ^b)
Medical effectiveness	20 (39 ^a)	32 (51 ^a)	14 (93 ^b)
Risks (e.g., driving impairment)	25 (49 ^a)	29 (46 ^a)	15 (100 ^b)
Legal/regulatory issues	38 (75 ^{ab})	39 (62 ^a)	14 (93 ^b)
Recreational use	16 (31 ^a)	26 (41 ^a)	9 (60 ^a)
Other	8 (16 ^a)	17 (27 ^a)	9 (60 ^b)
Total topics (M, SD)	7.35 ^a , 4.05	7.02 ^a , 5.01	12.60 ^b , 2.03

Note: Coursework with the same superscript (a, b) for Topic inclusion do not significantly differ by proportion, different superscripts indicate significant differences in the likelihood of Topic inclusion at $p < .05$. FDA = Food and Drug Administration; M = mean; SD = standard deviation