Improving Medical Student Knowledge and Reducing Stigmatizing Attitudes Toward Treating Patients With Opioid Use Disorder

Substance Use: Research and Treatment
Volume 18: 1–10

DOI: 10.1177/11782218241234808

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ABSTRACT

OBJECTIVES: Stigma and lack of knowledge are barriers to clinicians when caring for individuals with opioid use disorder (OUD). In 2018, only about 15 out of 180 American medical schools had comprehensive addiction programs. The AAMC reports that institutions are increasingly incorporating competencies to address the OUD and opioid epidemic. There have been few evaluated curriculums focused on reducing stigmatizing attitudes. This study evaluated whether a 4-hour case-based curriculum focused on improving stigmatizing attitudes toward patients with OUD could reduce medical student perceptions around viewing addiction as a punitive condition and other substitution-based misconceptions around opioid agonist-based medication.

METHODS: Medical students completed a 4-hour curricular workshop which included learning objectives focusing on barriers to healthcare/stigmatizing attitudes, effective behavioral therapy options, and appropriate use of opioid medications. We measured changes in knowledge and attitudes using validated scales on stigma. Non-parametric repeated measure tests determined statistically significant differences between pre and post assessments between OUD related perceptions and a control condition (diabetes).

RESULTS: Of 135 eligible participants, 99 (76%) students completed both pre- and post-surveys. Mean scores across knowledge questions improved (60%-81%, $P < .001$) and stigmatizing attitudes regarding perceived violence of people with OUD decreased (2.04-1.82, $P = .016$). There was significant improvement in mean scores for OUD-related opinions including desire to work with and effectively treat patients with OUD (3.58-3.88, $P < .001$) while no significant concurrent change was observed in mean opinion scores of a non-OUD comparator, diabetes (3.88-3.97, $P = .201$).

CONCLUSIONS: Results indicate that the workshop was associated with measurable changes in knowledge and attitudinal forms of OUD stigma. With recent policy changes eliminating the X-waiver, healthcare institutions are eager to design curriculum around OUD management and treatment. This study provides a blueprint for an effective curriculum that improves clinician knowledge and reduces stigmatizing attitudes.

KEYWORDS: Medical education, stigmatizing attitudes, opioid use disorder, medical student education, addiction

RECEIVED: October 1, 2023. **ACCEPTED:** February 7, 2024.

TYPE: Original Research

FUNDING: The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was funded by the Substance Abuse and Mental Health Services Administration (Grant #TI-H79TI081658) and the National Institute on Drug Abuse of the National Institutes of Health [Grant #K23 DA047475 (PAL)].

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Introduction

There were over 100 000 drug overdose deaths between April 2020 through April 2021, an increase of 28.5% from the 78 056 deaths from data collected between April 2019 and April 2020.[1] Despite increased awareness regarding the opioid crisis, opioid-involved death rates remain elevated,[2] which may indicate indicator that the current state of opioid use disorder (OUD) treatment and prevention is inadequate. Medications for OUD (MOUD) are considered the gold standard for initiating and sustaining long-term recovery.[3,4] Even though rates of MOUD prescribing have risen in recent years, current prescribing practices are not keeping pace with the rate at which the prevalence of OUD is increasing.[5] Specifically, estimates suggest that 86.6% of individuals with OUD who may benefit from MOUD treatment, do not receive these therapies.[6] According to recent studies, barriers to effectively treat these patients and prescribe MOUD are multifactorial and include restrictive policies, limited resources, and stigma due to potential negative physician attitudes toward patients with substance use disorder (SUD).[7-9]

Thus, there has been a national push to educate providers earlier in their careers, during medical school, to improve knowledge and attitudes toward treating patients with OUD. Skills in identifying and addressing substance use is recommended for

the majority of physicians with regular patient contact. Core competencies have been outlined by Accreditation Council for Graduate Medical Education that are recommended for every practicing physician.[10] As of 2018, as few as 15 out of 180 American medical schools teach comprehensive addiction programs, which vary widely across schools.[11] The Association of American Medical Colleges (AAMC) report that member institutions are incorporating additional competencies considered relevant to addressing the OUD and opioid overdose epidemic across all 4 years of medical school.[12] A growing number of studies indicate that medical education could address gaps in knowledge about SUD and decrease provider stigma through trainings that increase OUD awareness in medical students.[7,13-17] In November 2019, a scoping review evaluated peer-reviewed literature about SUD education in medical schools globally and determined SUD education, involving a variety of instructional methods such as active learning and objective structured clinical examinations (OSCEs) among others, provides a positive impact on knowledge, skills, and attitudes.[15] Despite the evidence for the efficacy of SUD interventions in medical education, to our knowledge there has been limited evidence around how to design a curriculum that both addresses knowledge gaps and also decreases stigmatizing attitudes toward patients with OUD.

Therefore, we developed a 4-hour hybrid asynchronous and synchronous workshop that included didactics around providing treatment for MOUD, identifying and diagnosing OUD, and understanding stigma and access barriers for individuals with OUD. It also included facilitator led case discussions to guide students through a series of 3 complex patient management scenarios. We hypothesized that this workshop would improve knowledge of identifying and treating OUD and decrease stigmatizing attitudes toward patients with OUD.

Methods

We evaluated the effects of a newly designed OUD curriculum on knowledge, stigmatizing attitudes, and satisfaction among a cohort of third-year medical students at a large university. All third-year medical students completing electives were included in this study. Students who were not considered to be third-year medical students and/or on leaves of absence were excluded from selection for this study. The students were provided with the following statement preceding the surveys: "Your responses to this survey will help us improve curriculum for future medical students. The information collected will not be stored with your name and will only be used by the research team for research and quality improvement purposes. We will aggregate your confidential individual responses, to create anonymous survey reports." This study was reviewed and approved by the institutional review board (Study ID: HUM00155840).

Curriculum/Intervention

Students completed a 4-hour hybrid workshop within a 1-month time frame in April, 2021, involving 2 components: 2.5 hours of asynchronous online lecture videos followed by a 1.5-hour case-based faculty-guided synchronous discussion held virtually. This cohort study used survey methodology to evaluate the efficacy of educational intervention, pre- and post-intervention. Initially, the 1.5-hour case-based discussions were planned to be hosted in-person. However, due to the COVID-19 pandemic, the case discussions were held virtually. Prior to the pandemic, the whole workshop was synchronous in its entirety. We decided to incorporate an asynchronous component to allow for more flexibility and reduce burden for students and faculty involvement. Furthermore, this choice allowed for an easier ability to scale this workshop across institutions and include facilitators from throughout the community who would otherwise have been unable to travel for an in-person workshop.

The conceptualization of this workshop was arrived at through use of Kern's 6-step approach,[18] including feedback from a targeted needs assessment and pilot study that was conducted at the same institution 2 years prior.[19] Course goals, lecture videos, and discussion materials were created in collaboration with buprenorphine-waivered faculty experienced in diagnosing and treating OUD. The specific content, presentation formats, and assessment tools used in this education intervention were developed through use of the "Integrated Course Design" framework, which focuses first on important situational factors and learning goals and then works toward building them into a cohesive whole unit.[20]

The asynchronous component consisted of 5 short videos on each of the following topics: (1) history of the opioid epidemic, treatment legislation and learning about buprenorphine as a treatment option (30 minutes), (2) stigma toward patients with chronic pain and OUD and access barriers to health care for patients on opioids (29 minutes), (3) introduction to addiction including the definition of addiction, pathophysiology, and epidemiology (26 minutes), (4) effective behavioral therapy options; screening, brief intervention, and referral to treatment (SBIRT)[21]; and motivational interviewing (18 minutes), and (5) appropriate use of the 3 medications for opioid use disorder, a focus on buprenorphine effectiveness, and harm reduction strategies (28 minutes).

These videos were added to a Canvas course[22] 3 weeks prior to the workshop. Students completed the videos at their own discretion during this time period. Following the videos, they completed an attestation statement that read, "By completing the survey below, you attest to having viewed the following SUD videos: History and Legislation, Stigma and Treatment Access, Introduction to Addiction, SBIRT and MI, and Medications for OUD."

The 1.5-hour faculty-guided discussion included 3 cases, covering the following treatment scenarios: (1) a patient interested in abstinence-based treatment for their heroin use disorder, (2) a patient with polysubstance use who has an aberrant urine toxicology screen and is deciding between buprenorphine or methadone treatment, and (3) a patient whose opioid

use for chronic pain has transitioned to OUD. Cases focused on determining appropriate medication and behavioral therapy options, identifying, and mitigating both patient and provider bias toward SUD and agonist treatment, and avoiding stigmatizing language. Discussion facilitators included X-Waivered providers with experience in addiction treatment. Facilitators were provided PowerPoint slides to review during the discussion and a detailed facilitator guide that included discussion probes and evidence-based responses. There were 10 total discussion groups that included between 10 and15 students each to allow for in-depth conversation and time for students to ask questions. Facilitators were trained to focus on issues related to stigma by (1) asking direct questions such as "What stigmatizing beliefs can you identify in this case?," (2) identifying stigmatizing language and non-stigmatizing alternatives (eg, "addict" vs "person with addiction"), and (3) identifying and discussing commonly held stigmatizing beliefs (eg, patients with SUD lack the self-control or willpower to stop using drugs).

Survey design

Medical students were sent both a pre- and post-survey to measure changes in knowledge, attitudes, and retention of opioid-related information. The pre-survey was exclusively shared through Canvas as the very first item students view when opening the course. The pre-survey was closed at the beginning of the synchronous portion of the workshop. The post-survey was sent via email following the small-group case discussion, and students were sent 3 email reminders to complete the survey. The post-survey was closed 14 days after the case discussion. A 5-dollar coffee house gift card was used to incentivize student responses to both the pre- and post-survey, for a total of up to a 10-dollar incentive for each student.

Survey questions

Likert scales and multiple-choice questions were used to assess responses in the following categories: demographics, attitudes toward patients with OUD and diabetes, comfort diagnosing and treating OUD, stigmatizing attitudes, knowledge, and student satisfaction (Appendix A). These third-year medical students had completed their core clinical clerkships at the time of the workshop, including a psychiatry clerkship, but had not completed any addiction-specific electives. In order to quantify prior didactic OUD experiences, we also assessed the number of students participating in the workshop who had previously completed the 8-hour Provider Clinical Support System (PCSS) X-waiver training.[23]

To measure change in knowledge and comfort over time, students were asked to answer 5 knowledge-related questions and 2 comfort-related questions in the pre- and post-surveys. Knowledge metrics included recognition of the 3 approved MOUDs and knowledge of buprenorphine's clinical uses and molecular mechanisms. Comfort questions were included to assess knowledge, attitude, skill, and confidence as one variable. There may be scenarios where clinicians have foundational knowledge but still feel uncomfortable treating a patient population due to other factors such as stigma or lack of resources.[24] Two questions from the Provider Clinical Support System (PCSS) X-Waiver[25] assessment bank regarding the distinction between OUD and physical dependence as well as the comparative efficacy of MOUD and non-medication treatment were also incorporated,[26,27] such as: "Moderate to severe opioid use disorder is different from simple physical dependence because. . .?." Comfort diagnosing and treating OUD was also assessed using questions such as, "How comfortable do you feel diagnosing patients with opioid use disorder (OUD)?." Overall student satisfaction with the educational intervention was also assessed during the post-survey.

A primary focus of this study was to assess how attitudes toward OUD change before and after the workshop. In order to effectively compare changing attitudes about OUD, students were also asked questions regarding attitudes on diabetes, a common chronic condition with similarly existing behavioral, medical, and social risk factors, that could be used as a comparator to OUD. Participants were asked to complete 2 question blocks with the same 6 questions: one block for OUD-related and the other for diabetes-related opinions. The change in pre-post scores for diabetes related attitudes were used as a comparison with the change in scores for OUD-related attitudes. For both the pre- and post-surveys, each participant was given each question block in a random order to prevent priming and survey bias. Questions regarding clinical attitudes toward patients (ie, those with diabetes and those with OUD) were adapted from the validated Drug Problems Perceptions Questionnaire[28] and Medical Condition Regard Scale,[24,29] and included statements such as, "I often feel uncomfortable when working with patients with OUD" and "In general, it is rewarding to work with patients with OUD."

Stigmatizing attitudes toward OUD were also assessed through selected items from the validated Perceived Dangerousness Scale,[30] Social Distance Scale,[31] and measures of support for punitive or harm reduction public policy measures (eg, naloxone distribution, prosecution for obtaining multiple opioid prescriptions).[32] Students also indicated their positions on several other questions designed by the study team regarding attitudes toward MOUD (eg, "I think using an opioid-based medication like methadone or buprenorphine for treatment is just substituting one opioid for another.").

This survey was first piloted among third-year medical students in 2019 to assess the efficacy of such a workshop, and we have tailored the curriculum and survey questions to provide more actionable feedback for revision of the educational materials, as well as elucidate causes of change in respondent attitudes (ie, we added additional stigma questions as a result of responses we received from the diabetes/OUD questions).

Statistical analysis

Pre- and post-surveys were matched by unique student usernames and paired scores were compared for each question. To evaluate change in knowledge over time, percent correct out of 5 knowledge check questions were calculated and compared. For questions with multiple correct answers, answers were only counted as correct if the participant selected all correct options. Data were analyzed descriptively and using statistical tests. Variables were evaluated for normality using visual inspection of histograms as well as the Shapiro-Wilk test of normality. For non-normal comparisons of paired results over time, Wilcoxon signed rank tests were used to assess statistical significance (using p-value, with statistical significance defined as $P < .05$). Family wise error rate was corrected using the Holm method.[33] Additionally, overall attitude scores were calculated and compared using linear mixed models (LMM) to evaluate changes between the OUD and diabetes phenotypes following the workshop. Post hoc examination of the model interactions was conducted using estimated marginal means. Data management and analysis was performed using Excel 2016 and R version 4.1.0, and statistical analysis was performed using R version 4.1.0.

In addition, we also compared changes in knowledge between those who had completed an 8-hour X-Waiver training prior to the workshop verses those who did not to assess if there was added benefit of the workshop. X-waiver training was incorporated into medical school curriculum using the SAMHSA Provider Clinical Support System (PCSS) during a mandatory opioids best practice course that students can take any time during their clinical rotation years (M2-M4).[34] The X-waiver training was not included in this course, but it was a graduation requirement. Since the X-Waiver training does not address stigma or attitudes of providers, this sensitivity analysis was limited to comparing changes in knowledge.

Results

In the 2020 to 2021 academic year, 135 medical students were eligible to participate in the workshop. 124 (92%) attested to having completed the asynchronous video modules. One hundred thirty-one students (97%) attended the workshop, 116 (86%) completed the pre-survey, and 114 (84%) completed the post-survey. Ninety-nine (76%) students completed both the pre-and post-surveys (Appendix B).

Of the 114 students who attended the workshop and completed the post-survey, 107 (94%) were satisfied or very satisfied with the overall quality of the training, and 112 (98%) would recommend this training to a colleague. An overwhelming majority (n = 103, 90%) found the workshop beneficial to their professional development and/or practice. Additionally, 97 (85%) students planned to use the information gained from this training to change their practice. Finally, 109 (96%) students found the facilitator to be effective in leading the case discussion.

Table 1. Student demographics.

CHARACTERISTIC	NO. OF PAIRED PARTICIPANTS (N = 99)	% OF PAIRED PARTICIPANTS
Gender		
Female	70	71%
Male	29	29%
Race/Ethnicity		
White	62	63%
Asian	17	17%
Black or African American	3	3%
Hispanic or Latino/Latina	2	2%
Multiple races	15	15%
Intended specialty		
Internal medicine	17	17%
Surgical specialty	15	15%
Anesthesiology	9	9%
Pediatrics	9	9%
General surgery	8	8%
OB/GYN	6	6%
Radiology	6	6%
Dermatology	5	5%
Family medicine	4	4%
Emergency medicine	3	3%
Neurology	1	1%
Psychiatry	1	1%
Undecided	10	10%
Other	5	5%

Of the 99 students who completed both pre- and post-surveys, 70 (71%) identified as female and 29 (29%) of students identified as male (Table 1). The majority of students (n = 62, 63%) identified as White, followed by Asian (n = 17, 17%), Black or African American (n = 3, 3%), and Hispanic or Latino/Latina (n = 2, 2%) (Table 1). The 2 largest intended specialties were Internal Medicine and Surgical specialties with 17 (17%) and 15 (15%) students, respectively (Table 1). Finally, 80 (81%) students had completed the online X-Waiver training prior to this workshop.

To assess changes in knowledge and attitudes from the pre-/post-surveys, we used data from the 99 students who completed both surveys. The mean percentage of correct answers to all 5 knowledge questions across pre- and post-test results increased from 60% to 81%, with an average score 21% higher on the

Table 2. Knowledge scores (n = 99).

SURVEY ITEM	ALL PARTICIPANTS (N = 99)				X-WAIVERED (N = 80)				NON X-WAIVERED (N = 19)			
	PRE	POST	DIFF.	*P*-VALUE	PRE	POST	DIFF.	*P*-VALUE	PRE	POST	DIFF.	*P*-VALUE
All knowledge questions[a]	60%	81%	21%	<.001	55%	83%	28%	<.001	61%	81%	20%	<.001
Which of the following are evidence-based medications for opioid use disorder?	25%	75%	49%		16%	74%	58%		28%	75%	47%	
What can buprenorphine be used for?	64%	77%	13%		58%	74%	16%		65%	78%	13%	
How does buprenorphine work?	77%	87%	10%		79%	84%	5%		76%	88%	12%	
Moderate to severe opioid use disorder is different from simple physical dependence because:	64%	79%	15%		58%	84%	26%		65%	78%	13%	
A 28-year-old man has had 3 supervised medical withdrawal treatments for opioid addiction with relapses shortly after discharge. The treatment with the strongest evidence of effectiveness would be:	71%	90%	19%		63%	100%	37%		73%	88%	15%	

[a]Scores across all knowledge questions indicate average number of questions correct.

Table 3. Comfort scores (n = 99).

SURVEY ITEM	PRE MEAN	POST MEAN	DIFFERENCE	*P*-VALUE
How comfortable do you feel diagnosing patients with opioid use disorder (OUD)?	2.96	3.69	0.73	<.001
How comfortable do you feel treating patients with opioid use disorder (OUD)?	2.63	3.41	0.78	<.001

post-survey ($P < .001$) (Table 2). Across all individual knowledge questions, scores increased from pre- to post-assessment. On a scale from 1 to 5, average comfort with diagnosing and treating patients with OUD increased from 2.96 to 3.69 and 2.63 to 3.41, respectively, after the intervention ($P < .001$) (Table 3).

After the workshop, medical students performed better on a test of objective knowledge than before the workshop, regardless of X-Waiver status (Table 2). Despite this previous training, students who completed the X-Waiver (n = 80) had pre- and post- survey scores of 61% and 81%, respectively. Those who had not completed the waiver training prior to the workshop (n = 19) had pre- and post- survey scores of 55% and 83%, respectively. Both X-Waiver and non-X-Waiver groups scores displayed a statistically significant improvement in pre- and post-survey scores ($P < .001$). Furthermore, the difference in pre- versus post-survey scores were not significantly different when differentiated by X-Waiver status ($P = .093$).

In addition, stigmatizing attitudes regarding OUD and MOUD decreased after the workshop (Table 4). On a scale from 1 to 4, perceptions of greater risk for violence among people with OUD decreased from a score of 2.04 to 1.82 ($P = .016$), and on a scale from 1 to 7, punitive attitudes toward individuals who obtain multiple opioid prescriptions from different doctors decreased from a score of 2.39 to 2.07 ($P = .016$). Regarding MOUD, interest in prescribing buprenorphine ($P = .016$), and agreement that medication is helpful for recovery from OUD ($P < .001$) and not a substitution for opioids ($P = .016$) increased. Of note, attitudes toward providing naloxone for opioid overdose reversal to friends and family members of people using opioids did not significantly change before and after the workshop ($P = .322$).

Finally, to understand how attitudes differ between patients with OUD and patients with diabetes, pre- and post-scores for each group of questions were averaged and compared (Table 5, Appendix C). Interaction between time and disease

Table 4. Stigma/MOUD scores (n = 99).

SURVEY ITEM	PRE MEAN	POST MEAN	DIFFERENCE	*P*-VALUE
Stigma				
Perceived Violence of people with OUD (Scale 1-4)	2.04	1.82	−0.22	.016
Arrest and prosecute individuals who obtain multiple prescriptions from different doctors (Scale 1-7)	2.39	2.07	−0.32	.016
Provide naxolone for opioid overdose reversal to friends and family members of people using opioids (Scale 1-7)	6.70	6.76	0.06	.322
MOUD				
Medication is helpful for recovery from OUD (Scale 1-5)	1.31	1.67	0.35	<.001
Opioid-Based Medication is just substituting opioids (Scale 1-7)	2.03	1.74	−0.29	.016
Interest in Prescribing Buprenorphine (Scale 1-5)	2.79	3.08	0.29	.016

Table 5. Pre-post OUD versus diabetes scores (n = 99).

SURVEY ITEM	OPIOID USE DISORDER (OUD)				DIABETES			
	PRE MEAN	POST MEAN	DIFFERENCE	*P*-VALUE[b]	PRE MEAN	POST MEAN	DIFFERENCE	*P*-VALUE[b]
Overall mean score	*3.58*	*3.88*	*0.30*	<.001	*3.88*	*3.97*	*0.08*	.201
I want to work with patients with OUD/ Diabetes	3.25	3.51	0.25		3.31	3.46	0.15	
I feel that the best I can personally offer patients with OUD/ Diabetes is a referral to somebody else[a]	3.36	3.61	0.24		3.62	3.87	0.25	
I feel that there is little I can do to help patients with OUD/ Diabetes[a]	3.88	4.28	0.40		4.22	4.39	0.17	
I often feel uncomfortable when working with patients with OUD/ Diabetes	3.16	3.46	0.30		4.10	4.02	−0.08	
In general, it is rewarding to work with patients with OUD/Diabetes	3.45	3.70	0.24		3.52	3.42	−0.09	
I believe medications work for OUD/Diabetes	4.24	4.68	0.43		4.56	4.60	0.04	

[a]Results for these question stems have been reverse coded, scores indicate disagreement with statement.
[b]*P*-values of estimated change using EMM.

type was significant ($P = .004$) at the 0.05 alpha level suggesting that the change in scores following the intervention were different for the OUD and diabetes questions. There was a positive change in mean score from 3.58 to 3.88 for OUD-related opinions after the intervention with an associated significant estimated marginal mean (EMM) effect (0.31 (0.20, 0.43); $P < .001$) indicating that stigmatizing attitudes toward patients with OUD decreased. The mean score regarding patients with diabetes also increased following the intervention from 3.88 to 3.97, however the EMM of this change was not found to be significant (.07 (.04, .19); $P = .201$) suggesting that while attitudes toward OUD appear to have improved,

attitudes toward diabetes, a non-intervention comparator, remained stable. Following the intervention, scores for all OUD-related opinion questions increased by at least 0.24 points, suggesting a general decrease in stigmatizing attitudes among all response variables.

Discussion

Our results indicated that a hybrid asynchronous and synchronous workshop implemented at a large university was associated with a decrease in stigmatizing attitudes and an increase in knowledge of opioid-related information. Stigmatizing attitudes regarding OUD and MOUD decreased significantly, and scores across all knowledge questions increased, with students on average scoring 21% higher on the post-survey. Furthermore, this workshop improved knowledge across all medical students, regardless of X-Waiver status. These findings suggest that additional training tailored to medical students is still necessary regardless of X-Wavier training status.

Additionally, there was not a significantly positive shift in attitudes regarding the use and availability of naloxone. This observation may be attributed to the high rates of misinformation about naloxone and overdose. A recent study showed moderate prevalence rates of inaccurate beliefs around opioid and naloxone, and also cited other literature indicating that attitudes toward naloxone may be influenced by repeated overdose statistics, political affiliation, and training availability.[35] Our results support that there is a need within medical school education to increase knowledge and training on the use and benefits of naloxone, in addition to MOUD.

Students also reported overwhelmingly high rates of satisfaction, with over 90% saying they were satisfied or very satisfied with the quality of training and that they would recommend the training to a colleague.

Considering the results of this study, it is reasonable to conclude that a hybrid asynchronous and synchronous workshop is effective in educating medical students on OUD and related stigma. Although remote and asynchronous instruction might be a concern for the level of student engagement, we found that the workshop produced high rates of satisfaction and positive results, while measurably increasing knowledge and stigmatizing attitudes among medical students. A remote and asynchronous program may offer advantages by increasing flexibility in scheduling for providers who are not all working at a similar site and to reduce travel burden for students. Additionally, incorporating pre-recorded videos from various faculty members and holding remote case discussions allowed students to learn from many more faculty members with varying backgrounds in addiction medicine than would have been feasible than holding an in-person session due to other competing faculty commitments and travel time. Our findings are consistent with the results of previous studies showing that educational workshops focused exclusively on OUD are well received with high levels of satisfaction[7] and result in positive changes in attitudes, increases in treatment optimism and confidence, and decreases in stereotyping.[7] However, in contrast to previous OUD-related studies, a primary focus and innovation of this evaluation was to assess attitudinal forms of stigma toward patients with OUD in comparison to a non-intervention comparator, diabetes. The workshop did not contain any content regarding diabetes. We included diabetes-related questions as a comparable biopsychosocial disease to determine if stigmatizing attitudes toward patients with OUD independently improved. This method of including diabetes-related questions has been previously used on studies evaluating clinician attitudes toward individuals with serious mental illness.[36] For diabetes-related questions, there was minimal change in attitude scores following the intervention while there was a positive, statistically significant change for opioid-related questions. The inclusion of questions regarding attitudes toward patients with diabetes indicates there was a decrease in stigmatizing attitudes toward patients with OUD specifically rather than toward chronic diseases in general. These results were further supported by a linear mixed model with an interaction term to compare slope change for each patient type over time. The significance of the interaction term suggests that favorable attitudes toward OUD grew at a greater rate than those of diabetes, the non-intervention comparator, and post hoc estimated marginal means suggested that there was a significant change in student OUD attitudes while attitudes toward diabetes remained relatively stable. In addition, the significant interaction term also suggests that the observed effects were less likely to have been a result of testing bias (eg, scores being modified by exposure to the instrument and items).

Further, high rates of satisfaction with the workshop and positive post-workshop outcomes provide evidence that the format of the hybrid and asynchronous curriculum could be a successful method of instruction for medical students to meaningfully engage in case discussions, retain knowledge, and improve attitudes regarding OUD. In contrast to previous studies, including the scoping review conducted in November 2019, our study implements several case discussions that enable students to independently execute and determine appropriate medication and behavioral therapy options, identify and mitigate both patient and provider bias toward SUD and agonist treatment, and avoid stigmatizing language.[15] Our study implements AAMC's core competencies by addressing medication treatment, focusing on OUD, and exposing students to first-person narratives.[12] In accordance with previous studies, our results indicate that first-person narratives and can be considered to be effective contact-based intervention that can reduce attitudinal forms of stigma toward SUD.[17] Providing our facilitators with scripted guides likely improved fidelity of facilitation to the intended content and optimal training in subgroups. The virtual format and use of scripted discussion guides would potentially allow for this workshop to be scalable across multiple institutions.

We acknowledge that the study has several limitations. First, our pre-survey was exclusively shared through Canvas at the same time asynchronous lecture materials went live and remained open until the beginning of the synchronous portion of the workshop. It is possible that some students may have taken the pre-survey after watching the videos, thus reducing the measured effect of the overall workshop because the pre-survey data could include the effects of the video content. However, this was unlikely due to survey location and text that instructed students to complete the survey prior to proceeding with any of the videos. In the case that a student completed the survey following the videos, the workshop's effect would be marginally larger than the effect reported in the data. Secondly, our study did not control for exposure to addiction medicine prior to this course. In fact, 80 (81%) students completed the X-Waiver course, which may have influenced our results. However, our results indicate that *all* students, including the ones who completed 8 hours of buprenorphine education via an X-Waiver, had a desirable change in knowledge and stigmatizing attitudes. Thus, we have room to believe that even with the X-waiver requirement being removed in 2023, this workshop has the potential to be a valuable curriculum to improve knowledge and reduce stigmatizing perceptions around SUD.

Furthermore, this study was run by 10 faculty members that are trained in addiction medicine, which may be a barrier for implementation at institutions with fewer trained educators. However, the curriculum and case studies were developed using scripted discussion guides that could allow even providers with less experience to guide some discussions. In fact, one of our discussions was led by an internal medicine resident with interest in addiction and was well received. Additionally, this study administered the post-workshop evaluation survey within 14 days after the workshop and did not assess the lasting effects or account for latency/recency of the post-survey assessments with the completion of the workshop. Assessing long-term retention of the knowledge and stigma improvements reflected on this immediate post-evaluation would provide further insight into the potential impact of this curriculum on clinical practice. Even though this study was not intended to measure causality, it is unlikely that statistically significant shifts in knowledge would otherwise occur within a few weeks. This curriculum was updated by formal evaluation and since 2019, this curriculum has been expanded and modified to include interprofessional learners including pharmacists, social work, nurse practitioner, and physician assistant students. Both facilitators and students are interprofessional and the modality of delivery has remained hybrid to allow for greater participation across SE Michigan, students, and multiple schools. We continue to gather post-workshop feedback to improve the didactics and case discussions. Future iterations of this workshop could work on expanding the content of the curriculum to include representation from those with lived experiences and additional inter-professional opportunities as opioid-related care is carried out by many clinicians. Moreover, qualitative evaluations could be used to garner a deeper understanding of which specific aspects of the course influenced the students' learning and how.

Conclusion

In summary, this study suggests that the hybrid workshop implemented at a large university can be effective in improving medical students' stigmatizing attitudes toward patients with OUD and knowledge of opioid-related content. The high rates of satisfaction with the workshop indicate that medical students found the workshop to be effective and beneficial for their future professional development and practice.

Authors' Note

Previous Presentations

Association for Multidisciplinary Education and Research in Substance use and Addiction 45th Annual Conference; November 4-5 2021; Virtual.

Acknowledgements

The authors wish to thank Edward Jouney, Michael Clay, and Golfo Tzilos Wernette for their contributions to this educational initiative, and Shivam Patel and Avani Yaganti for their assistance with initial planning of this study.

Author Contributions

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Design of evaluation instruments: Lagisetty, Thomas, Slat, Kehn, Macleod, Madden.

Data and statistical analysis: Chung, Macleod.

Drafting of manuscript: Chung, Slat, Kehne, Macleod, Lagisetty.

Critical revision of the manuscript for important intellectual content: Chung, Slat, Rao, Thomas, Kehne, Macleod, Madden, Lagisetty.

Ethical Approval

This study was reviewed and approved by the University of Michigan Institutional Review Board (Study # HUM00155840).

Disclaimers

None

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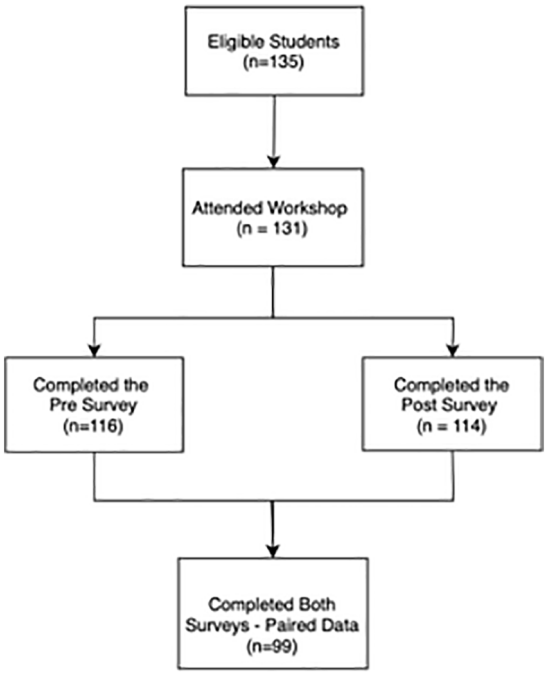
Appendix A. Full survey question stems.

OUD/Diabetes Provider Attitude/Individual Stigma Questions[24,28,29] Please indicate the extent to which you agree or disagree with each of the following statements about opioid use disorder (OUD): I want to work with patients with OUD. I feel that the best I can personally offer patients with OUD is referral to somebody else. I feel that there is little I can do to help patients with OUD. I often feel uncomfortable when working with patients with OUD. In general, it is rewarding to work with patients with OUD. I believe medications work for OUD. Please indicate the extent to which you agree or disagree with each of the following statements about diabetes: I want to work with patients with diabetes. I feel that the best I can personally offer patients with diabetes is referral to somebody else. I feel that there is little I can do to help patients with diabetes. I often feel uncomfortable when working with patients with diabetes. In general, it is rewarding to work with patients with diabetes. I believe medications work for diabetes.
Social/Punitive/Public Health Stigma Questions[30-32] In your opinion, how likely is it that a patient with OUD would do something violent toward other people? How strongly would you support or oppose a policy of arresting and prosecuting individuals who obtain multiple opioids prescriptions from different doctors? How strongly would you support or oppose a policy of providing naloxone (Narcan) for opioid overdose reversal to friends and family members of people using opioids?

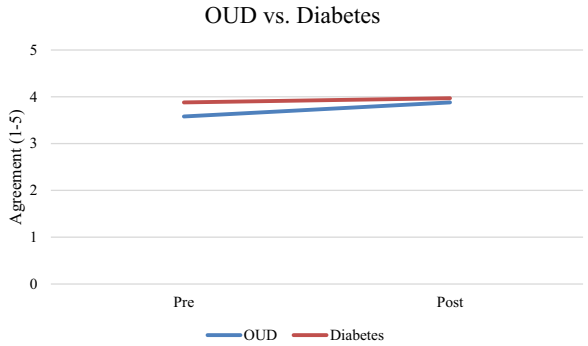
(Continued)

Appendix A. (Continued)

Comfort Questions[27] How comfortable do you feel *diagnosing* patients with opioid use disorder (OUD)? How comfortable do you feel *treating* patients with opioid use disorder (OUD)?
Knowledge Questions[25,26] Which of the following are evidence-based medications for opioid use disorder? (Select all that apply: Methadone, Clonidine, Buprenorphine, Naltrexone, Morphine, Cannabis, Naloxone) What can buprenorphine (often marketed as Suboxone) be used for? (Select one: A) Reducing pain, B) Treating stress or mood problems, C) Detox/drug treatment, D) A and C, E) A, B, and C) How does Buprenorphine work? (Select one: Opioid antagonist, Partial opioid receptor antagonist, Partial opioid agonist, Full opioid agonist) Moderate to severe opioid use disorder is different from simple physical dependence because: (Select one: There is tolerance, There are withdrawal symptoms on discontinuation of the drug) A 28-year-old man has had 3 supervised medical withdrawal treatments for opioid addiction with relapses shortly after discharge. The treatment with the strongest evidence of effectiveness would be: (Select one: Therapeutic community (e.g. AA or NA), Intensive outpatient counseling, Medication for opioid use disorder (MOUD), Medical withdrawal from opioids)
MOUD Opinion Questions[26] Do you feel treatment with medication or abstinence-based treatment is the most helpful for long-term recovery from opioid use disorder? (Select one: Medication is the most helpful, Medication treatment is moderately more helpful, Both treatments are equally helpful, Abstinence-based treatment is moderately more helpful, Abstinence-based treatment is the most helpful) Please indicate how much you agree or disagree with the following statement: I think using an opioid-based medication like methadone or buprenorphine for treatment is just substituting one opioid for another.
Future Practice Questions How interested are you in prescribing buprenorphine following residency?
Satisfaction Questions How satisfied were you with the overall quality of this training? Please indicate the extent to which you agree or disagree with the following statement: I expect this training to benefit my professional development and/or practice. Please indicate the extent to which you agree or disagree with the following statement: I will use the information gained from this training to change my current practice. Please indicate the extent to which you agree or disagree with the following statement: I would recommend this training to a colleague. Please indicate the extent to which you agree or disagree with the following statement: Overall my facilitator was effective in leading the case discussion. Please feel free to provide any feedback on ways we can improve the lecture videos and/or patient case discussion on opioid use disorder you completed during the 2021 Branches Intensive.



Appendix B. Participant inclusion.



Appendix C. Pre-post OUD versus diabetes mean scores.