

peer-review in advance, both for critical evaluation of trial design as well as that negative data cannot be selectively ignored in final publication. Despite these qualifiers, there is a pressing need to critically appraise the results of commercially funded clinical research. Several proposals exist such as enforcing third-party, independent statistical analysis of RCTs or, most revolutionary, restricting participation of those with significant COI [11].

## Conclusion

Clinical trials are paramount in providing guidance in clinical treatment. Results have the power to upset prevailing clinical dogma—yet many trial results are downgraded or dismissed in clinical guidelines because of the presence of biases. Through assiduous trial design and ethical reporting of all results, including negative findings, trials become valid, reproducible, and applicable to clinical decisions. Surgical trials remain the most challenged by these concerns, especially by complex pathology-based risk stratification, placebo effects, blinding, and COI from the medical industry. Thus, it will be important to address these areas for improvement, starting with increased critical awareness of the trap of low-quality RCTs.

## Abbreviations

COI = conflict of interest; RCT = randomized controlled trial; CONSORT = Consolidated Standards of Reporting Trials

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## COMMENTARY

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Commentary

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# Pain Education During the Coronavirus Pandemic: The Introduction of Pain Medicine During the Pre-Clinical Years

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## Introduction

The coronavirus disease 2019 (COVID-19) pandemic has greatly affected nearly all aspects of medicine from healthcare delivery to medical education. While patient care and community health initiatives have been the bulk of the focus, the current long-term effects on medical education are substantial [1–3]. The Association of American Medical Colleges (AAMC) published guidelines advising medical schools to suspend in-person clinical rotations for medical students in mid-March of 2020 [4]. These guidelines were created for the core hospital clerkships and clinical electives for third- and fourth-year medical students. Moreover, these guidelines did not include extracurricular medical school organizations and meetings such as interest groups and pre-clinical electives.

The extent of medical students' exposure to clinical rotations differs per institution. All in-person medical school clerkships were canceled at our academic institution in Providence, Rhode Island during the initial peak of the pandemic. Furthermore, our institution facilities were also temporarily shut down and as a result the pre-clinical electives were forced to transition to virtual platforms, and many were cancelled altogether. There were numerous justifications for cancelling in-person clerkships which included but were not limited to: helping statewide efforts to socially distance and limit virus spread, decreasing the risk of exposure to medical students, and preserving personal protective equipment for hospital employees [5, 6].

During these unorthodox times, medical educators are tasked with addressing the necessity to train students within the parameters of safety and social distancing policies. With this in mind, the introductory pain medicine pre-clinical elective was initiated as a virtual, eight-week course utilizing the “flipped classroom” model with synchronous and asynchronous learning activities [7, 8]. This was the first time the course was offered, virtual or otherwise. The goal was to establish an online curriculum, including interactive modules, dedicated lectures, and small group presentations, encapsulating an introduction to all the core components of an ACGME Pain Medicine Fellowship. In addition, we included a component that discusses issues in patient relationships and equitable health care particularly as it pertains to chronic pain. Our intention was to help fill gaps in knowledge during medical training and to increase awareness of the pain medicine field to all medical professionals regardless of future career choices. This commentary reviews the curriculum, resources, and outcomes from the first 8-

week virtual preclinical elective, entitled “BIOL 6702: Introduction to Pain Medicine.”

## Curriculum Design and Overview

The virtual pain medicine elective was designed collaboratively in July 2020 by the Brown University Anesthesiology Department faculty, senior anesthesiology residents, and third- and fourth-year medical student members of the Anesthesiology Interest Group. A formal application was submitted to the medical school administration expressing the need for an introductory pre-clinical pain medicine elective. In 2021, following institutional approval, the pre-clinical elective was offered for the first time to first- and second-year medical students. Faculty lecturers were recruited by the anesthesiology residents and members of the Anesthesiology Interest Group. A total of 8 Brown University faculty members were involved in lecturing the students: a palliative care pain specialist, a pain fellowship trained emergency medicine physician, an acupuncturist, and pain specialists.

The elective was offered during an eight-week block on Monday evenings after the core curriculum lectures. The “flipped-classroom” method was used where students completed online learning assignments or readings independently at their own pace prior to the real-time, virtual teaching activities on the same topic. Major components of the course were: online learning assignments/readings, weekly pain medicine conferences via virtual video conferences, student presentations, and two session surveys: prior to the course and at the completion of the course. The course objectives were to: 1) learn the different diagnostic modalities and therapeutic procedures that pain medicine offers and understand their appropriate uses, 2) recognize the indications and contraindications for common imaging interventions and associated safety considerations, 3) understand the importance of patient relationships and equitable health care to all populations, 4) provide an introduction to outcomes research in pain, 5) introduce pain medicine mechanisms, and 6) identify the basics of pain medicine including the “most common” diagnoses.

Brown University email was used to communicate with the students in real time throughout the workweek outside of the sessions. Specifically, course leaders used email to send assignments and meeting reminders, distribute surveys, and respond to student questions regarding curriculum content, materials, and logistics. Students were asked to complete a survey prior to the

**Table 1.** The Schedule for Introduction to Pain Medicine at The Warren Alpert Medical School of Brown University (BIOL 6702)

| Week | Topic  |
|------|--|
| 1    | Course introduction and overview<br>History of pain<br>What is pain medicine? How do I get there?                                |
| 2    | A day in the life of a pain physician<br>What is chronic pain?<br>What are the different types of pain?<br>Patient relationships |
| 3    | Beyond clinical practice: research in pain medicine and humanistic alternative approaches to pain relief                         |
| 4    | Opioids and pharmacology   |
| 5    | Neuromodulation and interventional/invasive procedures   |
| 6    | Multidisciplinary rounds   |
| 7    | Ultrasound workshop  |
| 8    | Student presentations  |

The course met weekly from 5 to 7 p.m. and was held via virtual video conferencing.

initiation of the course and at the completion of the course to assess their perceptions and knowledge base on various course components and elements of pain medicine. The survey consisted of seven questions including open text boxes and a Likert scale (1 = strongly disagree, 7 = strongly agree) and were administered via Google Forms email invitations. Participation in the survey was voluntary.

Session topics were broad, and department faculty governed the specific content of a week's lecture as shown in [Table 1](#). Slide sets were composed by the lecturers for each given week. In addition, students were asked to read articles prior to course meetings to be familiar with material. For example, students were given an article describing the standard interventional procedures performed in pain medicine [9] and an overview of pain mechanisms [10] prior to the lecture. The procedures that were discussed included epidural steroid injections, diagnostic blocks, trigger point injections, radiofrequency ablation, interspinous spacers, kyphoplasty, sacroiliac joint fusions, dorsal column and root stimulators, intrathecal pumps, and cranial electrical stimulation. The discussion on pain mechanisms and management included a brief look at the anatomy, physiology, and pharmacology of nociceptive stimuli.

## Results

A total of eight medical students were enrolled in the 8-week virtual elective between the months of February and April 2021. There was a 100% response rate for the pre- and post-course surveys, of which 25% (2/8) reported taking the course because they are considering a career in pain medicine. This sentiment was also reflected in the responses to the question, "What are you looking to learn from this course?" The open-text responses included comments such as "[I'd like to] learn

more about pain medicine because it feels relevant to all specialties," "I want to learn about different pain management techniques and how the field of pain medicine may be growing and changing," and "I also think the physiology of pain is really interesting and it feels really important to learn more about it with the current opioid epidemic."

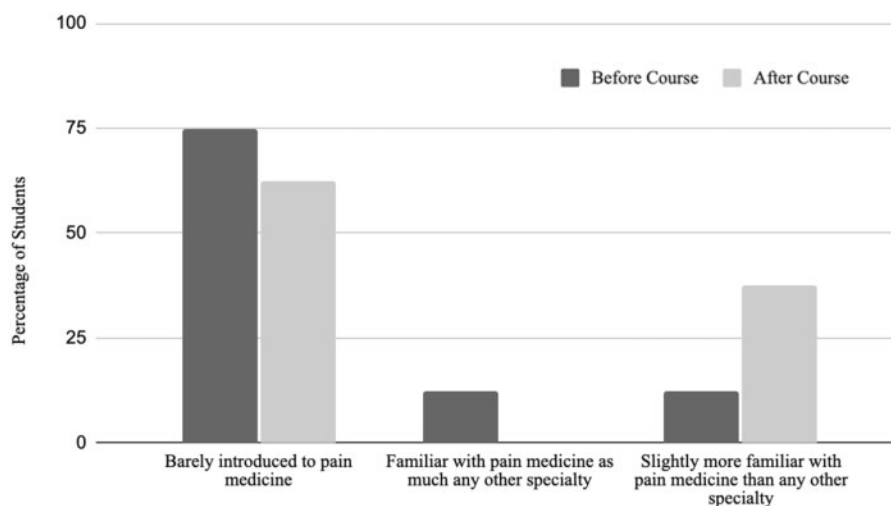
Course participants were asked how they would rate their understanding of pain medicine and their results are presented in [Figure 1](#), which showed that, after 8 weeks, there was a 25% increase in students who reported that he/she felt "slightly more familiar with pain medicine than any other specialty." Responses to the quantitative survey questions are presented in [Table 2](#). At the completion of the course, all of the participating students (8/8) would recommend this course to other classmates.

## Discussion and Lessons Learned

We successfully implemented an 8-week introductory elective to interventional pain medicine for first- and second-year medical students at the Alpert Medical School of Brown University, with a secondary aim of attracting medical students to the field of pain medicine. Due to the COVID-19 pandemic, the curriculum was adapted to an exclusively virtual platform. Eight students completed the elective course and demonstrated an improved understanding of the field of pain medicine.

The creation of this course highlights the interest for increased exposure of preclinical medical students to pain medicine. Our experience is similar to a previously published report that conducted interviews and focus groups among medical students and educators of a large academic institution and found that the undergraduate medical curriculum was inadequate [11]. Thus far, the only exposure that Alpert Medical School provided was an optional clinical elective on interventional pain medicine offered through the Department of Surgery for third- and fourth-year medical students. There were no other formal teaching modalities for first- and second-year medical students offered at our institution. We are pleased to share our experiences and resources with other teaching medical institutions during this unprecedented time. Our lectures and reading materials, available upon request, combined with video conferencing technology make this course accessible and reproducible and allows other medical teaching institutions to adopt it into their own curriculum.

There are several lessons to be learned from this new introductory pain medicine elective course. First, we concluded that the virtual platform is successful in promoting student recruitment due to its accessibility and efficiency. Technological advances in image archiving and viewing have lent themselves to enhance remote learning for medical students. In addition, improvements in web-conferencing and student response system



**Figure 1.** First- and second-year medical students participating in the elective course “Introduction to Pain Medicine, BIOL 6702.” at The Warren Alpert Medical School of Brown University. Survey Question: “How would you rate your understanding of pain medicine?”

**Table 2.** The pre and post survey results of the quantitative survey questions given to the participants enrolled in the Introduction to Pain Medicine course at The Warren Alpert Medical School of Brown University (BIOL 6702)

| Survey Items   | Pre-Course Mean | Post-Course Mean |
|--|-----------------|------------------|
| Q1. I understand what pain physicians do and the procedures they perform.      | 4.4             | 5.8              |
| Q2. I know when to consult pain medicine for assistance in patient management. | 4.0             | 5.7              |
| Q3. How many different pain medicine procedures are you aware of?              | 3.1             | 6.1              |

For items 1 and 2 scale of answers were 1: Strongly disagree, 2: Disagree, 3: Somewhat disagree, 4: Neutral, 5: Somewhat agree, 6: Agree, 7: Strongly Agree.

software have contributed greatly to our ability to offer students a robust and interactive virtual learning experience [12, 13]. Our experience is similar to previous reports in other specialties which have demonstrated great success using these innovative teaching strategies [14, 15]. We will likely carry forward a virtual component of the elective in some form since it was well received by the students. Despite the success of the virtual platform, the most common difficulty expressed by the participants was still the lack of in-person interaction. The students felt that they would benefit more if the lecturer were present in the same room providing a more personal experience. As the coronavirus pandemic restrictions gradually taper, in addition to virtual courses, we would incorporate opportunities for more in-person ultrasound workshops, tours of fluoroscopy suites, and faculty shadowing experiences. This would allow students to be more active participants and provide for a more hands-on learning experience.

Second, we identified that the course curriculum requires modification. We initially wanted to create interest in the field by drawing attention to the cutting-edge, interventional side that pain medicine offers. Due to the introductory nature of the course designed for first- and

second-year medical students, we have decided to scale down the complexity of the procedures described in the course to parallel the knowledge of the anatomy and physiology of the students. Limiting the discussion on pain procedures and expanding upon topics such as multimodal, opioid-sparing pharmacological approaches, novel pain research, and racial and socioeconomic disparities within pain medicine may prove to create a more balanced and digestible curriculum for preclinical students.

Third, student input in formulating the course curriculum allowed us to incorporate the topics of most interest and of most use to them as medical students. It was also beneficial to have medical students and residents working together in the faculty recruitment process. Students and residents invited speakers which created a multidimensional group of lecturers with their own unique perspective on the field of pain medicine.

Finally, we learned that the elective provides an opportunity to discuss the inequities and disparities that occur within pain medicine. Physicians may contribute to disparities in healthcare by making biased decisions that are driven, in part, by their attitudes about race and socioeconomic status [16, 17]. By introducing pain medicine early

in the medical school curriculum with discussions on patient relationships and inequities within the field, we hope to promote the importance of advocacy and equity within pain management, building open-minded clinicians who are aware of their own implicit biases.

## Conclusions

Launching the virtual pain medicine elective has been an overwhelmingly positive experience and we hope that it can eventually be weaved into the pre-clinical core curriculum. Results from our post-course survey showed that the participants enjoyed the experience and reported a better understanding of common pain diagnoses, different types of practices of pain physicians and recognizing when to refer complex pain conditions to a pain specialist. Moreover, the participants have expressed that they felt more prepared for their future clinical rotations. Understanding the challenges and the importance of effective pain management created a shift in perspective for many of the participants. In fact, several participants are considering pain medicine as a career choice for the first time. While the launch of this preclinical pain medicine elective was a successful one, it is nonetheless important to recognize that curriculum initiatives should not be final and that future iterations of the course should be adaptable to student and contemporary needs and priorities.

## Author's Contributions

All authors contributed to the drafting and critical revision of the manuscript for accuracy and intellectual content and approved the final manuscript for publication.

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