

The evolution of teaching and learning regional anesthesia at every career stage: The U.S. perspective

ABSTRACT

Regional anesthesia and analgesia are integral to modern perioperative medicine and contribute to multimodal analgesia and enhanced recovery protocols. Over the past two decades, regional anesthesia practice has changed dramatically with the incorporation of real-time ultrasound guidance. Anesthesiologists in the U.S. who completed residency training in the early 2000s were not routinely taught how to use ultrasound for regional anesthesia, and subspecialty fellowships in regional anesthesia at that time were relatively few and varied widely in terms of educational experience. Today, the state of regional anesthesia education in the U.S. is completely different and has embraced a multipronged, multigenerational approach that addresses the needs of anesthesiologists in training, as well as anesthesiologists in practice throughout the career lifecycle. This review will cover the current state of regional anesthesia education for residents, fellows, and practicing anesthesiologists and will note important historical advances, as well as future trends that may shape the curricula for regional anesthesia learners in formal training and continuing education.

Key words: Acute pain, fascial plane block, medical education, nerve block, pain management, postoperative pain, regional anesthesia, simulation, teaching

Introduction


The practice of regional anesthesia, particularly in the categories of peripheral nerve and fascial plane blocks, has completely changed in the past 25 years with the integration of real-time ultrasound guidance.^[1] Concurrently, there have been a number of influential trends in surgical practice, such as the adoption of enhanced recovery protocols that stress early mobility and shorter hospital stays, increased emphasis on non-opioid pain management with awareness of the opioid

epidemic and historical contribution of overprescribing, and healthcare economic pressures that have led to the growing shift of major surgeries such as arthroplasty to the outpatient setting.^[2-4] Regional anesthesia and analgesia can play a critical role in each of these major trends, and recent international collaborative projects have named and defined a large volume of techniques at the disposal of the anesthesiologist to improve the perioperative outcomes and the experience of patients who have surgical and other invasive procedures.^[5,6]

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Unfortunately, studies show that regional anesthesia is not consistently used even for surgeries in which there is established evidence of efficacy.^[7-9] Changing clinical practice can be challenging since physician careers are so long. For example, an anesthesiologist in 2025 who has been in practice for 20 years may still work for another decade or more but did not learn ultrasound guidance for regional anesthesia or any of the newer techniques that rely on ultrasound for performance (e.g., fascial plane blocks) during anesthesiology residency. Therefore, to change clinical practice and improve patient access to regional anesthesia, teaching and learning regional anesthesia must adopt a multi-pronged, multi-generational approach that addresses the needs of anesthesiologists in training as well as anesthesiologists in practice throughout the career lifecycle.

In this review article, we will cover the current state of regional anesthesia education for residents, fellows, and practicing anesthesiologists and will note important historical advances as well as future trends that may shape the curricula for regional anesthesia learners in formal training and continuing education.

Literature Review

To generate a broad list of source articles, we searched the MEDLINE database using PubMed.gov (United States National Library of Medicine, National Institutes of Health, Bethesda, MD, USA) between October and December 2024 using the following key words, phrases, and combinations: “regional anesthesia training,” “regional anesthesia education,” “regional anesthesiology simulation,” and “regional anesthesia advances.” A systematic review was not conducted, and all article types were considered. Articles deemed relevant by title and/or abstract were critically reviewed for regional anesthesia educational modalities, themes, innovations, and trends. The reference lists of these articles were also reviewed for additional articles that may not have been included in the search engine results. Three temporal themes emerged from the literature related to phases of regional anesthesia training: residency; subspecialty fellowship; and continuing education or lifelong learning. Each of these themes is summarized in the sections that follow.

Basic regional anesthesia training in residency

Residency training is the beginning of an anesthesiologist's focused specialty training and is pivotal in the development of foundational knowledge and clinical skills. Over the decades, formal education in regional anesthesia during

anesthesiology residency has changed profoundly with the assistance of technology. This section explores the evolution of teaching methods in regional anesthesia training for residents.

Prior to the establishment of regional anesthesia subspecialty fellowships, regional anesthesia was largely considered a component of general anesthesiology practice.^[10] Training in regional anesthesia was largely informal and opportunistic, relying on apprenticeship style training under the tutelage of the early proponents of regional anesthesia.^[10] In the U.S., standardized residency program requirements established through the Anesthesiology Residency Review Committee (RRC) of the Accreditation Council for Graduate Medical Education (ACGME) included a minimum requirement of “40 care experiences” with patients who received peripheral nerve blocks as part of their anesthetic, which is frequently misinterpreted as a minimum threshold performance of 40 peripheral nerve blocks.^[11] Even if residency programs did interpret the minimum number of peripheral nerve block procedures to be 40 per resident, those without an intentional model designed to maximize resident nerve block performance failed to consistently achieve this threshold.^[12] However, even if residents were able to achieve the desired procedural volume in their case logs, available evidence questioned whether or not true competence was actually achieved. A study by Sites *et al.*^[13] showed that after performing at least 60 supervised nerve blocks during a regional anesthesia rotation, residents still made an average of 2.8 errors per block, with the most common errors being advancing the needle without visualization, poor transducer handling and malposition of the target during ultrasound imaging.

In 2009, the American Society of Regional Anesthesia and Pain Medicine (ASRA Pain Medicine) and the European Society of Regional Anesthesia and Pain Therapy (ESRA) published the first joint recommendations on education and training in ultrasound-guided regional anesthesia, which included learning pathways for both trainees and practicing anesthesiologists.^[14] This international collaborative project defined specific skills desired in the practice of ultrasound-guided regional anesthesia using a core competency framework, suggested potential programmatic investments (e.g., ultrasound coordinator position), and provided a standardized technique for ultrasound scanning when performing nerve blocks.^[14] This article has been used to guide the refinement of regional anesthesia rotations within anesthesiology residency programs, as well as workshop offerings at continuing education events, especially those that involve simulation.^[15-17]

The integration of simulation into undergraduate medical education (i.e., medical school) and graduate medical education (i.e., residency and fellowship) has been widely accepted, and this is very relevant in regional anesthesia. From the perspective of competency-based education, the use of simulation facilitates graduated levels of progression from novice to expert as the trainee develops competency in various areas of practice.^[18] For residents who have not previously performed an ultrasound-guided nerve block and are starting their regional anesthesia rotation, basic ultrasound competency may be demonstrated first on an organic or inorganic (e.g., gel) phantom with target scanning, needle tracking, and visualization of the needle tip.^[17] The progression to live ultrasound scanning of models to demonstrate transducer handling, machine adjustment, and identification of sonoanatomy may precede actual ultrasound-guided nerve block performance on patients. Simulation in the early learning period has been shown to lead to more successful blocks in clinical practice with fewer errors.^[19] Other educational tools used in regional anesthesia education for residents include: didactic lectures; problem-based learning discussions; online resources such as videos; and published articles. Although residents tend to focus on achieving technical proficiency in nerve block performance, the ability to anticipate and manage side effects and unanticipated complications of regional anesthesia is critically important, and simulation offers an ideal setting to teach crisis resource management.^[16,17]

In residency programs at hospitals with high clinical workload and constant time pressure, focused teaching in regional anesthesia can be very challenging. If feasible, dedicated nonclinical didactic days for residents have been proposed as a solution.^[20] Garcia-Tomas *et al.*^[20] studied the impact of dedicated didactic days on regional anesthesia education and showed improvements in knowledge and skills that were attributed to the protected time and controlled, low-pressure environment for learning.

One challenge in basic regional anesthesia training for residents is the large volume of techniques currently available, which have emerged with the adoption of ultrasound. While there may be good reasons to have multiple block options for the same type of surgery or acute pain indication, especially in the hands of experts, having too many choices can be intimidating to new learners. In response, Turbitt *et al.*^[11] have suggested that early training in regional anesthesia should focus on developing competency in a limited set of high value blocks which these authors have called “Plan A blocks.” Plan A blocks are suggested regional anesthesia techniques that may be useful for the most common surgical procedures involving the upper limb, lower limb, and trunk.^[11]

While the authors provide a suggested list (interscalene brachial plexus block, axillary brachial plexus block, femoral nerve block, adductor canal block, sciatic nerve block at the popliteal fossa, erector spinae plane block, and rectus sheath block),^[11] other institutions and residency programs may choose to replace any of these blocks with an acceptable alternative. An international consensus project on developing a non-fellowship regional anesthesia curriculum has validated the regions of the body targeted by the list of Plan A blocks and provides further guidance on non-technical skills and assessment tools that should also be included in regional anesthesia training for residents.^[21]

Advanced regional anesthesia training in fellowship

Fellowship training is not currently required to practice regional anesthesia in the U.S. However, few anesthesiology residency graduates gain sufficient clinical experience during their required rotations to provide optimal care to the wide variety of patients who suffer from postoperative pain. It would not be unusual for a resident to graduate with only a single four-week rotation in regional anesthesia. As previously discussed, given the large volume of regional anesthesia techniques available today, many residency programs have begun to focus basic regional anesthesia rotation objectives on Plan A blocks.^[11] For anesthesiology residents who anticipate having careers in practice environments that may require a broader and deeper knowledge of regional anesthesia and acute pain medicine, advanced training after residency in the form of a fellowship may be warranted. In addition, the specialized knowledge and skills developed in a focused period of training may be highly desirable by future employers.

The structure of fellowship programs has undergone major changes in the past two decades, the fellowship directors of regional anesthesia programs in the U.S. and educators with an interest in advanced training in regional anesthesia have met every year to share program developments and areas of opportunity. Recognizing the potential role for training standardization, they voluntarily developed and published a set of suggested fellowship guidelines in 2005 that could be used by program directors to update existing programs or start new ones.^[22] These guidelines were subsequently updated and published by the fellowship directors group in 2011^[23] and 2015.^[24] Since the regional anesthesia fellowships were not accredited nationally and subject to external review at the time, any adherence to published guidelines was voluntary.

This changed in 2016 when Regional Anesthesia and Acute Pain Medicine (RAAPM) became a one-year subspecialty

fellowship accredited by the ACGME within the specialty of anesthesiology.^[10,25] To be accredited, a fellowship program had to apply to the ACGME and demonstrate how it provided the learning environment and content described in the program requirements developed and approved by the ACGME. The program requirements and answers to frequently asked questions are freely available online on the ACGME website (<https://www.acgme.org/specialties/anesthesiology/program-requirements-and-faqs-and-applications/>). Nine RAAPM fellowship programs applied in the first round and were granted initial accreditation in 2017.^[25] The initial accreditation period is 2 years, after which newly accredited programs must be externally reviewed by ACGME for continuing accreditation status. As of March 2025, 45 RAAPM fellowship programs have been accredited in the U.S.

Upon completion of RAAPM fellowship training, graduates are expected to command expertise in a wide range of regional anesthetic techniques, including catheter insertion and management, as well as acute pain medicine for patients who undergo surgery or suffer from traumatic injuries and certain medical conditions. Fellowship-trained RAAPM physicians may serve as the acute pain specialists within an institution and provide consultation to surgical colleagues regarding challenging pain management issues.^[3,26] They can serve as an educational resource and provide training in regional anesthesia techniques and multimodal analgesia to their anesthesiology colleagues and/or residents, when applicable for faculty in academic programs.

Regional anesthesiologists and acute pain medicine specialists may also take the lead within their institutions in developing enhanced recovery pathways and multi-disciplinary acute pain services. In addition to interventional techniques (e.g., nerve blocks), intravenous infusions of ketamine and/or lidocaine may aid in the management of acute postoperative pain and require oversight by an acute pain service.^[27,28]

In recent years, the subspecialty of RAAPM has continued to expand its clinical scope into transitional pain, which addresses the gap in postoperative pain medicine services after discharge from the hospital and preoperative optimization of complex patients (those with chronic pain, long-term opioid therapy, or substance use disorder) scheduled for surgery.^[26,29,30] Transitional pain services may incorporate tools that have been traditionally used in the management of patients with chronic pain such as behavioral modification and other mental health interventions, cryoanalgesia, and neuromodulation.^[31,32] Given the epidemic of opioid use and other substance use disorders, anesthesiologists, surgeons, and other perioperative clinicians have had to learn to address

the special needs of these patients when they have surgery. ACGME has incorporated a requirement for education on substance use disorder across all training programs, including RAAPM, and ASRA Pain Medicine has published guidelines for the management of buprenorphine in the perioperative period.^[33] Within these guidelines are recommendations on initiating buprenorphine when indicated for hospitalized patients under the care of the acute pain services, and there are examples of acute pain services that have taken this next step and offer this training to their RAAPM fellows.^[34]

Lifelong Learning in Regional Anesthesia for the Practicing Anesthesiologist

Nearly half of surveyed ASRA Pain Medicine members have reported inadequate training in peripheral nerve blocks and their clinical management.^[35] Although these data are 15-years-old, many of the respondents may still be in practice given the long duration of physician careers. Lack of adequate training and confidence in regional anesthesia skills may be contributing to continued inconsistency in the utilization of regional anesthesia for surgical patients. Even if residents have completed basic training in regional anesthesia and have been deemed competent at the time of graduation, the field of RAAPM continues to change every year. In addition, residency graduates may change jobs during their careers, and a new position may require greater knowledge and skills in regional anesthesia. As patients presenting for surgery have become more challenging from a pain management perspective, particularly those taking buprenorphine for chronic pain or opioid use disorder,^[33,36] even fellowship-trained RAAPM specialists may need additional education.

Changing clinical practice outside of the training environment can be difficult. Cabana *et al.*^[37] have previously identified many of these barriers, both internal and external, that can prevent the adoption of new evidence-based guidelines: lack of awareness; lack of familiarity; lack of self-efficacy; lack of outcome expectancy; unwillingness to change engrained practice; and external systemic barriers (e.g., lack of equipment, medications, support). Dissemination of guidelines and new evidence through various channels can help to address some of these internal barriers. The editorial by Turbitt *et al.*^[11] that first described Plan A blocks was widely shared on social media, achieving an Altmetric score of 166, and has been cited over 100 times. National and international societies such as Regional Anesthesia U.K., ASRA Pain Medicine, and ESRA have adopted the Plan A blocks framework to their continuing education offerings, such as hands-on ultrasound scanning workshops, conference lectures, and webinars.

Reputable sources for lifelong learning in regional anesthesia can come from society memberships. For example, ASRA Pain Medicine and ESRA publish their own member newsletters which feature articles on timely topics and upcoming in-person and virtual events. Scientific journals have started to move away from the paradigm of monthly print issues and now published articles online as soon as they are accepted and copyedited. At continuing education conferences hosted by these societies, attendees can choose to attend sessions based on their specific interests and practice demands. Hands-on ultrasound scanning and simulation-based workshops may be particularly useful for practicing anesthesiologists, who wish to develop or advance their existing skills in regional anesthesia.^[15,38,39]

Online educational resources are ubiquitous as nearly every anesthesiologist carries a mobile phone with internet access. Podcasts produced by societies, journals, and experts in regional anesthesia and pain medicine offer education on the go, which consumers can listen to during their commute or while exercising. Social media platforms vary in terms of content delivery and capacity for engagement but may be very useful as educational and networking tools.^[40,41] Video-based platforms can offer short just-in-time training for regional anesthesia procedures (e.g., YouTube, TikTok, Instagram) or even house full-length plenary lectures that provide comprehensive coverage of a particular topic. Other platforms are primarily text-based (e.g., X, Bluesky) but offer link sharing to resources and can be utilized for networking (i.e., asynchronous interactions with authors and thought leaders). Platforms such as Facebook and LinkedIn can be used to create and manage groups, which may be formed based on common interests. The sheer volume of available digital resources worldwide provides greater accessibility and flexibility in continuing education, which may help physicians to stay up to date with scientific discoveries, practice guidelines, and regulatory changes. However, those who use social media for education need to pay careful attention to their sources, as self-publishing does not undergo the peer-review, fact-checking, and editing that are expected from scientific journal articles.

The future of teaching and learning in regional anesthesia will be heavily influenced by technology. The use of virtual reality may obviate the need for a traditional standalone simulation center, which may eventually help practicing anesthesiologists engage in simulation-based training without needing to travel.^[42-44] In 2022, the U.S. Food and Drug Administration approved artificial intelligence (AI) technology that creates color overlays of anatomical structures on live ultrasound images, with the goal

of aiding physicians who perform ultrasound-guided regional anesthesia procedures less frequently.^[45] The use of this AI technology has been validated in the preclinical setting.^[46-48] Another proposed application of AI in regional anesthesia education is in curriculum development using large language models.^[49,50] Large language models (e.g., ChatGPT) may assist the busy practicing anesthesiologist in summarizing the published literature on topics of interest in regional anesthesia and pain medicine, but concerns have been raised regarding the veracity of the AI-generated answers and references.^[51] However, AI technology is evolving at an extremely rapid pace, and solutions to these issues can be expected in the near future (if they do not already exist by the time this article is published).

Conclusion

In summary, the practice of regional anesthesia has dramatically changed in the past two decades, mostly due to the widespread adoption of ultrasound guidance, and education in regional anesthesia has had to change with it. To increase patient access to regional anesthesia techniques for perioperative pain management, effective methods for teaching regional anesthesia must take a multi-generational approach, which entails targeting the learner at every career stage: anesthesiology resident; advanced clinical fellow, for those who choose this path; and practicing consultant anesthesiologist. Since there will undoubtedly be advances in this subspecialty in the years ahead, the learning can never stop. Over the course of a career, sources for continuing education must be made available for anesthesiologists to keep up with the latest technology, develop new skills, and learn evidence-based best practices that they can implement to improve patient care.

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References

1. Mariano ER, Marshall ZJ, Urman RD, Kaye AD. Ultrasound and its

- evolution in perioperative regional anesthesia and analgesia. *Best Pract Res Clin Anaesthesiol* 2014;28:29-39.
2. Joshi GP, Kehlet H. Postoperative pain management in the era of ERAS: An overview. *Best Pract Res Clin Anaesthesiol* 2019;33:259-67.
 3. Mariano ER, Dickerson DM, Szokol JW, Harned M, Mueller JT, Philip BK, *et al.* A multisociety organizational consensus process to define guiding principles for acute perioperative pain management. *Reg Anesth Pain Med* 2022;47:118-27.
 4. Li J, Rubin LE, Mariano ER. Essential elements of an outpatient total joint replacement programme. *Curr Opin Anaesthesiol* 2019;32:643-8.
 5. El-Boghdadly K, Wolmarans M, Stengel AD, Albrecht E, Chin KJ, Elsharkawy H, *et al.* Standardizing nomenclature in regional anesthesia: An ASRA-ESRA Delphi consensus study of abdominal wall, paraspinal, and chest wall blocks. *Reg Anesth Pain Med* 2021;46:571-80.
 6. El-Boghdadly K, Albrecht E, Wolmarans M, Mariano ER, Kopp S, Perlas A, *et al.* Standardizing nomenclature in regional anesthesia: An ASRA-ESRA Delphi consensus study of upper and lower limb nerve blocks. *Reg Anesth Pain Med* 2024;49:782-92.
 7. Cozowicz C, Poeran J, Zubizarreta N, Mazumdar M, Memtsoudis SG. Trends in the use of regional anesthesia: Neuraxial and peripheral nerve blocks. *Reg Anesth Pain Med* 2016;41:43-9.
 8. Gabriel RA, Kaye AD, Nagrebetsky A, Jones MR, Dutton RP, Urman RD. Utilization of femoral nerve blocks for total knee arthroplasty. *J Arthroplasty* 2016;31:1680-5.
 9. Gabriel RA, Nagrebetsky A, Kaye AD, Dutton RP, Urman RD. The patterns of utilization of interscalene nerve blocks for total shoulder arthroplasty. *Anesth Analg* 2016;123:758-61.
 10. Shapiro DM, Hargett MJ, Kopp S, Neal JM, Mariano ER, Liguori G. History and evolution of regional anesthesiology and acute pain medicine fellowship training. *Reg Anesth Pain Med* 2020;45:311-4.
 11. Turbitt LR, Mariano ER, El-Boghdadly K. Future directions in regional anaesthesia: Not just for the cognoscenti. *Anaesthesia* 2020;75:293-7.
 12. Richman JM, Stearns JD, Rowlingson AJ, Wu CL, McFarland EG. The introduction of a regional anesthesia rotation: Effect on resident education and operating room efficiency. *J Clin Anesth* 2006;18:240-1.
 13. Sites BD, Spence BC, Gallagher JD, Wiley CW, Bertrand ML, Blike GT. Characterizing novice behavior associated with learning ultrasound-guided peripheral regional anesthesia. *Reg Anesth Pain Med* 2007;32:107-15.
 14. Sites BD, Chan VW, Neal JM, Weller R, Grau T, Koscielniak-Nielsen ZJ, *et al.* The American Society of Regional Anesthesia and Pain Medicine and the European Society of Regional Anaesthesia and Pain Therapy joint committee recommendations for education and training in ultrasound-guided regional anesthesia. *Reg Anesth Pain Med* 2010;35:S74-80.
 15. Kumar AH, Sultan E, Mariano ER, Udani AD. A modern roadmap for the use of simulation in regional anesthesiology training. *Curr Opin Anaesthesiol* 2022;35:654-9.
 16. Ramlogan RR, Chuan A, Mariano ER. Contemporary training methods in regional anaesthesia: Fundamentals and innovations. *Anaesthesia* 2021;76(Suppl 1):53-64.
 17. Udani AD, Kim TE, Howard SK, Mariano ER. Simulation in teaching regional anesthesia: Current perspectives. *Local Reg Anesth* 2015;8:33-43.
 18. Woodworth G, Maniker RB, Spofford CM, Ivie R, Lunden NI, Machi AT, *et al.* Anesthesia residency training in regional anesthesiology and acute pain medicine: A competency-based model curriculum. *Reg Anesth Pain Med* 2020;45:660-7.
 19. Niazi AU, Haldipur N, Prasad AG, Chan VW. Ultrasound-guided regional anesthesia performance in the early learning period: Effect of simulation training. *Reg Anesth Pain Med* 2012;37:51-4.
 20. Garcia-Tomas V, Schwengel D, Ouanes JP, Hall S, Hanna MN. Improved residents' knowledge after an advanced regional anesthesia education program. *Middle East J Anaesthesiol* 2014;22:419-27.
 21. Chuan A, Jeyaratnam B, Fathil S, Ferraro LH, Kessow A, Lim YC, *et al.* Non-Fellowship regional anesthesia training and assessment: An international Delphi study on a consensus curriculum. *Reg Anesth Pain Med* 2021;46:867-73.
 22. Hargett MJ, Beckman JD, Liguori GA, Neal JM. Guidelines for regional anesthesia fellowship training. *Reg Anesth Pain Med* 2005;30:218-25.
 23. The Regional Anesthesiology and Acute Pain Medicine Fellowship Directors Group. Guidelines for fellowship training in Regional Anesthesiology and Acute Pain Medicine. Second Edition, 2010. *Reg Anesth Pain Med* 2011;36:282-8.
 24. Regional Anesthesiology and Acute Pain Medicine Fellowship Directors Group. Guidelines for fellowship training in regional anesthesiology and acute pain medicine: Third edition, 2014. *Reg Anesth Pain Med* 2015;40:213-7.
 25. Mariano ER, Rosenquist RW. The road to accreditation for fellowship training in regional anesthesiology and acute pain medicine. *Curr Opin Anaesthesiol* 2018;31:643-8.
 26. Dickerson DM, Mariano ER, Schwenk ES. Multiorganizational consensus on principles for perioperative pain management for patients with chronic pain, opioid tolerance, and substance use disorder: An infographic. *Reg Anesth Pain Med* 2024;49:725.
 27. Hunter OO, Lu A, Fretwell D, Mariano ER. Implementing an intravenous ketamine protocol for acute pain in the medical-surgical setting. *J Am Assoc Nurse Pract* 2023;35:98-103.
 28. Hunter OO, Wong A, Leng J, Mariano ER. Educating nurses on intravenous lidocaine for postoperative pain management. *Pain Manag Nurs* 2021;22:94-9.
 29. Harrison TK, Mariano ER, Clark JD, Mudumbai SC, Hunter OO. Lessons learned from establishing a transitional pain service in the USA. *Reg Anesth Pain Med* 2025;50:184-7.
 30. Sun EC, Mariano ER, Narouze S, Gabriel RA, Elsharkawy H, Gulur P, *et al.* Making a business plan for starting a transitional pain service within the US healthcare system. *Reg Anesth Pain Med* 2021;46:727-31.
 31. Coffman CR, Leng JC, Ye Y, Hunter OO, Walters TL, Wang R, *et al.* More than a perioperative surgical home: An opportunity for anesthesiologists to advance public health. *Semin Cardiothorac Vasc Anesth* 2023;27:273-82.
 32. Ye Y, Gabriel RA, Mariano ER. The expanding role of chronic pain interventions in multimodal perioperative pain management: A narrative review. *Postgrad Med* 2022;134:449-57.
 33. Kohan L, Potru S, Barreveld AM, Sprintz M, Lane O, Aryal A, *et al.* Buprenorphine management in the perioperative period: Educational review and recommendations from a multisociety expert panel. *Reg Anesth Pain Med* 2021;46:840-59.
 34. Seol A, Chan J, Micham B, Ye Y, Mariano ER, Harrison TK, *et al.* Acute pain service reduces barriers to buprenorphine/naloxone initiation by using regional anesthesia techniques. *Reg Anesth Pain Med* 2023;48:425-7.
 35. Ramlogan R, Manickam B, Chan VW, Liang L, Adhikary SD, Liguori GA, *et al.* Challenges and training tools associated with the practice of ultrasound-guided regional anesthesia: A survey of the American society of regional anesthesia and pain medicine. *Reg Anesth Pain Med* 2010;35:224-6.
 36. Harrison TK, Kornfeld H, Aggarwal AK, Lembke A. Perioperative considerations for the patient with opioid use disorder on buprenorphine, methadone, or naltrexone maintenance therapy. *Anesthesiol Clin* 2018;36:345-59.
 37. Cabana MD, Rand CS, Powe NR, Wu AW, Wilson MH, Abboud PA, *et al.* Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA* 1999;282:1458-65.
 38. Kim TE, Ganaway T, Harrison TK, Howard SK, Shum C, Kuo A, *et al.* Implementation of clinical practice changes by experienced anesthesiologists after simulation-based ultrasound-guided regional anesthesia training. *Korean J Anesthesiol* 2017;70:318-26.

39. Mariano ER, Harrison TK, Kim TE, Kan J, Shum C, Gaba DM, *et al.* Evaluation of a standardized program for training practicing anesthesiologists in ultrasound-guided regional anesthesia skills. *J Ultrasound Med* 2015;34:1883-93.
40. Kirpekar M, Kars MS, Mariano ER, Patel A. The professional use of social media in anesthesiology: Developing a digital presence is as easy as ABCDE. *Anesth Analg* 2024;139:238-43.
41. Kumar AH, Udani AD, Mariano ER. The future of education in anesthesiology is social. *Int Anesthesiol Clin* 2020;58:52-7.
42. Chuan A, Bogdanovych A, Moran B, Chowdhury S, Lim YC, Tran MT, *et al.* Using virtual reality to teach ultrasound-guided needling skills for regional anaesthesia: A randomised controlled trial. *J Clin Anesth* 2024;97:111535.
43. Zheng T, Xie H, Gao F, Gong C, Lin W, Ye P, *et al.* Research and application of a teaching platform for combined spinal-epidural anesthesia based on virtual reality and haptic feedback technology. *BMC Med Educ* 2023;23:794.
44. Chuan A, Qian J, Bogdanovych A, Kumar A, McKendrick M, McLeod G. Design and validation of a virtual reality trainer for ultrasound-guided regional anaesthesia. *Anaesthesia* 2023;78:739-46.
45. Larkin HD. FDA approves artificial intelligence device for guiding regional anesthesia. *JAMA* 2022;328:2101.
46. Bowness JS, Morse R, Lewis O, Lloyd J, Burckett-St Laurent D, Bellew B, *et al.* Variability between human experts and artificial intelligence in identification of anatomical structures by ultrasound in regional anaesthesia: A framework for evaluation of assistive artificial intelligence. *Br J Anaesth* 2023;132:1063-72.
47. Bowness JS, Macfarlane AJR, Burckett-St Laurent D, Harris C, Margetts S, Morecroft M, *et al.* Evaluation of the impact of assistive artificial intelligence on ultrasound scanning for regional anaesthesia. *Br J Anaesth* 2023;130:226-33.
48. Bowness JS, Burckett-St Laurent D, Hernandez N, Keane PA, Lobo C, Margetts S, *et al.* Assistive artificial intelligence for ultrasound image interpretation in regional anaesthesia: An external validation study. *Br J Anaesth* 2023;130:217-25.
49. Nanda M, Grant SA. Leveraging artificial intelligence for regional anesthesiology curriculum development. *Reg Anesth Pain Med* 2024:rapm-2024-105906. doi: 10.1136/rapm-2024-105906.
50. Schroeder KM, Elkassabany N. Artificial intelligence and regional anesthesiology education curriculum development: Navigating the digital noise. *Reg Anesth Pain Med* 2024:rapm-2024-105522. doi: 10.1136/rapm-2024-105522.
51. Wu CL, Cho B, Gabriel R, Hurley R, Liu J, Mariano ER, *et al.* Addition of dexamethasone to prolong peripheral nerve blocks: A ChatGPT-created narrative review. *Reg Anesth Pain Med* 2024;49:777-81.

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