

A Survey of Regional Anesthesia Use In Greece And The Impact of A Structured Regional Anesthesia Course On Regional Techniques Knowledge And Practice

Kassiani Theodoraki (✉ ktheodoraki@hotmail.com)

National and Kapodistrian University of Athens

Eleni Moka

Creta Interclinic Hospital

Alexandros Makris

Asklepieion Hospital of Voula

Evmorfia Stavropoulou

General Hospital of Attica KAT

Research Article

Keywords: anesthesiologists, neurostimulation, peripheral, ultrasound

Posted Date: May 28th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-518833/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Due to the growing interest in regional anesthesia (RA) techniques and the realization of the need for formalized education in them, the Greek Chapter of the European Society of Regional Anesthesia and Pain Therapy (ESRA-Hellas) has established a structured hands-on training Course held annually since 2009, which is quite popular in the community of Greek anesthesiologists. The aim of the current survey was two-fold: first to provide an overview about the current practice of RA in Greece and secondly to evaluate the effect the aforementioned training Course has on participants' knowledge and attitude towards RA.

Methods: An electronic questionnaire was uploaded on SurveyMonkey and a link giving access to the questionnaire was forwarded via email to an electronic database of 825 practicing Greek anesthesiologists held in the electronic database of ESRA Hellas. The survey was totally anonymous and no identifying information was collected throughout. It contained questions relating to the anesthesiologists' demographic characteristics, their RA practice and information pertaining to the RA training Course.

Results: A total of 424 fully completed questionnaires were received, representing an overall response rate of 51.4%. Attendants of the Course are more familiar with the performance of peripheral nerve blocks with neurostimulation and/or ultrasound guidance as compared to non-attendants ($p < 0.001$). Attendants are also less likely to practice exclusively general anesthesia, more likely to use peripheral blocks for lower limb surgery and more likely to consider taking the European Diploma of RA in comparison to non-attendants ($p < 0.001$, $p = 0.018$ and $p = 0.002$, respectively). Both cohorts consider the Course of value and agree that the main reason to use regional techniques is to ensure optimal postoperative analgesia while the main hindrance to RA practice is the lack of relevant education in the techniques, especially those under ultrasound guidance. Regarding improvement of the Course, most participants suggested devoting ampler time in ultrasound hands-on practice and application.

Conclusion: Greek anesthesiologists seek educational activities in the field of RA and the Course seems to fulfil the majority of attendants' expectations. There will be further effort by the organizers to improve weaknesses of the current Course and undertake further educational initiatives in the field of RA according to international recommendations.

Introduction

During the past 30 years there has been a tremendous increase in the popularity of regional techniques, both for provision of anesthesia for surgery and also as part of the armamentarium of postoperative pain management. Regional anesthesia (RA) offers many benefits as compared to general anesthesia. It provides high-quality intra- and postoperative analgesia while at the same time decreases excess opioid consumption and its associated side effects, ensuring high levels of patient satisfaction. Additionally, there is evidence that the implementation of regional techniques attenuates the surgery-associated stress

response and postoperative cognitive dysfunction, enhances postoperative bowel recovery, facilitates early ambulation and shortens duration of hospitalization [1, 2]. Furthermore, there is strong evidence that RA reduces resource utilization achieving cost-effectiveness and having far-reaching economic implications [3]. Finally, an anticancer and anti-inflammatory effect of regional techniques has also been postulated [4, 5].

Due to the growing interest in RA and the realization that its administration is a core skill required by all anesthesiologists, many National Anesthesia Societies and Education Committees worldwide have established training courses aiming at educating anesthesiologists in regional techniques. In light of this, the Greek Chapter of the European Society of Regional Anesthesia and Pain Therapy (ESRA Hellas) has established a structured five-day intensive hands-on RA teaching module held annually since 2009. This Course consists of theoretical didactic lectures on the principles of RA, the basics of ultrasound (US) machine operation, image optimization, recognition of sonoanatomy, scanning techniques and practice on manufactured or non-human tissue phantoms (blue phantom gel models and porcine meat) as well as identification of needle insertion points and US scanning on volunteer live models. The Course has been attended by a significant number of Greek Anesthesiologists from all parts of Greece so far, is quite popular and consistently gets high rankings among participants.

In general, there is considerable variation in the practice of RA among anesthesiologists and among different countries [6–9]. In this respect, national surveys can provide valuable data for comparisons and for information concerning the transfer of evidence to clinical routine. We have previously published the results of the only nationwide survey of RA use in Greece, which aimed at investigating the trends of RA practice in the country during the year 2011 [10]. As mentioned in that publication, the collected data were considered to serve as a benchmark for future comparisons and for evaluation of the efficacy of running training programs and teaching efforts in the field of RA. That survey however was addressed to Directors of Greek Anesthesiology Departments and not to individual anesthesiologists, therefore individual practice and routine were not clearly presented. Another limitation of the previous survey, which had in fact been acknowledged in the resulting publication, was the relatively small number of responding Directors, since only 66 completed questionnaires were collected out of the 230 nationwide Anesthesiology Departments.

The aim of the current online survey was two-fold: first to conduct a nationwide voluntary anonymous response survey to document the current practice of RA in Greece. The difference from the previous survey lay in the fact that we aimed at individual anesthesiologists in the hope that responses would be more representative of individual practices rather than departmental ones and that the survey would provide a comprehensive overview of the current status of individual RA practice. Secondly, we sought to elucidate whether the aforementioned training course in RA, which is now over its 10-year anniversary, has achieved its goals in offering targeted education and consolidating knowledge and skills in the field of RA amongst Greek Anesthesiologists. Our ultimate goal was to elaborate on the Course's strengths and weaknesses and to identify deficiencies with the target of paving the way for instructor feedback, self-assessment and improvement.

Methods

The survey was endorsed by the Scientific Committee of ESRA Hellas and was undertaken from 26th February 2020 to 26th March 2020. All methods were performed in accordance with relevant guidelines and regulations and followed set research practices for surveys [11]. After obtaining approval from the Institutional Review Board (194/25-02-2020) and after registering the study at the clinicaltrials.gov website (ClinicalTrials.gov ID: NCT04406025), an electronic questionnaire was compiled and uploaded on SurveyMonkey (SurveyMonkey Inc., SanMateo, California, USA, www.surveymonkey.com), a web-based commercially available survey research platform tool that allows users to create their own surveys, using question format templates. The questionnaire had been thoroughly reviewed for content and structure by two senior certified consultants with vast experience in RA to ensure validity and clarity and to correct ambiguities and misinterpretations. It was agreed upon by consensus between them. It consisted of questions focusing on anesthesiologists' demographic characteristics, their RA practice as well as information relating to the aforementioned RA Course. The questionnaire was tested in different browsers and platforms to ensure smooth conduct. It was further validated by pilot testing on five senior anesthesiologists who provided feedback that was incorporated into the final survey. On average the sample questionnaire took eight minutes to complete. A secure link giving access to the online questionnaire created using the SurveyMonkey website was sent via email to a mailing list of 825 practicing Greek anesthesiologists held in the electronic database of ESRA Hellas. All anesthesiologists working in state, private and academic Hospitals according to the data of the Society were invited to participate since our objective was to reach a representative sample nationwide. The questionnaire was accompanied by a short narrative explaining the purpose of the survey and inviting all colleagues to participate, however no monetary compensation or any other incentive was provided for completion of the questionnaire. The survey was open for one month and the respondents could choose either desktop or mobile device to complete it via the secure link, however each IP address was allowed to complete the survey once. Two subsequent reminders were sent thereafter via follow-up emails and through popular electronic social media (i.e. the Facebook page of ESRA Hellas) within the period of the month during which the survey was open, kindly requesting from anesthesiologists to complete the questionnaire. After initial mailing and the subsequent follow-up reminders, the survey was closed one month after the initial distribution. All responses were collected at the end of the month through the SurveyMonkey website. The survey was totally anonymous and no identifying information was collected.

The questionnaire contained 32 multiple-choice questions (MCQs) and one free-text question. At the end of the questionnaire, informed consent was obtained from respondents to the survey to use provided anonymized data for research purposes (**Appendix**). In the MCQs, selection of best answer was only possible while rating scales were included in some of the questions depending on the context. The survey consisted of two parts: First, it included basic demographic information about the anesthesiologists' hospital job position and level, years of clinical practice, type of hospital, techniques of anesthesia used in the hospital, percentage of operations performed under RA in the respective hospitals, type of equipment available in the hospital allowing the performance of regional anesthetic techniques and

personal preference, frequency and practice of the physicians regarding RA techniques in general in the context of their current routine practice. Participants were additionally enquired regarding knowledge and confidence on performing neuraxial and peripheral nerve blocks (PNBs), utilization of catheters after neuraxial or PNBs for provision of postoperative analgesia and use of US and/or nerve stimulation guidance in their practice of regional techniques. There were also questions pertaining to respondents' personal beliefs on the advantages of RA and on factors hindering its broad application in the participants' working environments.

The second part of the questionnaire focused on the experience of the participants with the aforementioned RA Course. Those that had attended the Course were enquired about the main reason urging them to participate in it and whether they felt that the Course added to their knowledge, confidence and competence regarding neuraxial and peripheral RA techniques. Information was sought about whether after the Course their motivation to engage in RA increased, whether they asked for the provision of relevant equipment in their working environments and whether they were met with any obstacles in this provision. They were also asked about whether they considered the Course of value in RA Education, about whether they would suggest its attendance to other colleagues and were asked to suggest areas for improvement of the Course. Finally, those anesthesiologists who had not attended the Course were asked about the reason for not doing so and, irrespective of their lack of attendance, whether they thought that the Course was valuable in RA education. Finally, the survey was concluded with a general question addressed to all participants regarding thoughts for participation in the examination for the European Diploma of Regional Anesthesia (EDRA).

Data were coded and were stored anonymously on the SurveyMonkey host server. They were then downloaded for analysis into an Excel Database and were subsequently analyzed with the SigmaPlot for Windows v.13.0 statistical software (Systat Software, Inc., San Jose, CA). Descriptive statistics (frequency distributions) were computed to summarize the data. Differences in characteristics and attitudes between anesthesiologists who had exposure to the RA course and those who did not were analyzed with chi square analyses, with Yate's correction and Fisher's exact test, as appropriate. For the level of knowledge in central and peripheral blocks and in order to allow comparisons, a 5-point Likert scale was used and categories were coded as follows: 0, no knowledge; 1, little knowledge; 2, average knowledge; 3, very good knowledge; 4, expertise. For the comparison in the levels of knowledge between the anesthesiologists who attended the Course and those who did not, the Mann-Whitney U-test for independent samples was used while for the comparison in the levels of knowledge in the performance of blocks among all respondents, the Wilcoxon signed-rank test was used. Results are presented as number (frequency) for categorical variables and as median [25th-75th percentile] for the results of the Likert scale and were considered significant at the $p < 0.05$ level.

Results

As already mentioned, the survey was forwarded to 825 practicing anesthesiologists. A total of 424 responses were obtained with fully completed questionnaires, corresponding to an overall response rate

of 51.4%. The majority of the respondents (33.7%) reported that they work in central National Health Service (NHS) hospitals and that they are consultants with more than 10 years of experience in anesthesia practice (42.7%). Most people (40.3%) stated that they work in hospitals where all types of anesthetic techniques are practiced (general anesthesia, neuraxial blocks and peripheral blocks with both neurostimulation and US guidance) and most (30.6%) also reported that the percentage of operations under RA in their practicing hospitals is between 31–50%. Most respondents also ascertained that they practice in hospitals where they have readily access to both neurostimulators and an US machine and that there is availability of a local anesthetic systemic toxicity (LAST) kit in their departments (57.0% and 69.8% respectively) (Table 1).

The vast majority of respondents (94.8%) stated that they know about the RA Course organized annually by ESRA Hellas but more than half of them (55.4%) have not attended it (Table 1). The majority of anesthesiologists who have attended the Course (89.4%) stated that their main motive for doing so was to improve knowledge and skills in RA. Most anesthesiologists who have attended the Course agreed that it contributed considerably to acquiring knowledge in central neuraxial blocks, in central neuraxial blocks under US guidance, in PNBs with neurostimulation and in PNBs under US guidance (with percentages of 58.7%, 40.7%, 46.0% and 49.7%, respectively). However, when enquired whether the knowledge they acquired changed their everyday practice of RA, the majority of them (46.0%) stated it changed their everyday practice only a little, attributing this fact to the ongoing lack of competence in US use. Still, the majority of anesthesiologists attending the Course (59.2%) declared that it provided the motive for requesting the provision of relevant equipment from their hospital services (Table 2).

When enquired about their personal anesthesia practice, most respondents (39.8%) stated that this mainly consists of general anesthesia and neuraxial blocks without US guidance. However, those who have not attended the Course are more likely to practice mainly general anesthesia as compared to those who have attended the Course ($p < 0.001$). In contrast, anesthesiologists who have attended the Course are more familiar with providing all anesthesia techniques (general anesthesia, central blocks and PNBs with neurostimulation and/or US guidance) in comparison to non-attendant counterparts ($p = 0.008$). In addition, when specifically enquired regarding personal practice in PNBs, the majority of respondents (31.1%) stated that they seldom try to perform them because of lack of confidence and expertise. However, when responses to this question were analyzed in terms of the attendance of the Workshop, anesthesiologists who have attended the Workshop are twice as likely to perform PNBs under US guidance compared to those who have not attended it ($p < 0.001$). Additionally, there is a higher chance that anesthesiologists who have not attended the Course work in hospitals where operations amenable to PNBs (such as orthopedic cases) do not take place, as compared to those who have attended the RA Course ($p = 0.006$). Most respondents (33.2%) also stated that their primary choice for anesthesia technique in lower limb surgery is a neuraxial block. Still, there is a higher chance for performing a PNB in lower limb surgery among those who have attended the Workshop ($p = 0.018$) and a higher chance for working in a hospital where such surgery does not take place among those who have not attended the Workshop ($p = 0.033$), (Table 3).

Respondents were also enquired regarding their level of knowledge in central and peripheral blocks. The majority of anesthetists (49.8%) ascertained their very good knowledge in central blocks, with no difference between those who have and those who have not attended the Course (3 [3–3] vs. 3 [2–3], $p = 0.059$) (Fig. 1a). However, most of the respondents (39.4%) declared that they have little knowledge in the performance of central blocks under US guidance with a significant difference however between those who have and those who have not attended the Course (1 [1–2] vs. 1 [0–1], $p < 0.001$) (Fig. 1b). As to PNBs, most respondents (27.4%) noted their average knowledge in the performance of these blocks aided by neurostimulation with the difference between those who have and those who have not attended the Course also significant (2 [1–3] vs. 1 [1–2], $p < 0.001$) (Fig. 1c). Lastly, when enquired about their knowledge in the performance of PNBs under US guidance, most respondents (31.4%) reported that they have little knowledge in doing so, with a significant difference still between those who have and those who have not attended the Course (2 [1–3] vs. 1 [0–2], $p < 0.001$) (Fig. 1d).

According to the results of the survey, knowledge in PNBs with neurostimulation among all respondents far exceeds their knowledge in PNBs with US guidance (2 [1–3] vs. 1 [0–2], $p < 0.001$). Similarly, respondents are more familiar with the performance of PNBs with US as compared to the performance of central blocks with US (1 [0–2] vs. 1 [0–2], $p < 0.001$). Lastly, the difference in the performance of central blocks with traditional anatomic landmarks as compared to the performance of these blocks via US guidance is also highly significant (3 [2–3] vs. 1 [0–2], $p < 0.001$).

Regarding the use of catheters, the majority of respondents (72.4%) often use an epidural catheter for the provision of postoperative analgesia, with no difference between those who have and those who have not attended the course ($p = 0.176$). However, when enquired about the use of catheters after PNBs, a high percentage of respondents (41.5%) stated that they never use a catheter for the provision of postoperative analgesia. However, higher use of catheters among those who attended the Course was demonstrated and the difference with non-attendants was highly significant ($p < 0.001$), (Table 3).

Both groups agreed that the main reason for performing RA techniques is the provision of more optimal postoperative analgesia with no difference between attendants and non-attendants ($p = 0.573$). Other reasons quoted were safety, improved outcome, reduction of complications and reduced cost of hospitalization in descending order. The primary impediment to the wider application of regional techniques is the lack of education in them, with no difference between those who attended and those that did not attend the Course ($p = 0.991$). Other key barriers listed were long duration of RA procedures, reluctant surgeons, patient refusal, concern for potential complications and fear of failure in descending order. (Table 3).

A high percentage of the anesthesiologists (88.4%) who have attended the RA Course would recommend its attendance to their colleagues (Table 2), while the main reason for non-attendance among non-attendees is their busy work schedule (48.9%) (Fig. 2). However, both groups agree that the Course contributes considerably to Greek Anesthesiologists' education in RA (Table 2 and Fig. 3a), with no difference between those who have and those who have not attended the Course ($p = 0.313$) (Fig. 3b).

Finally, although the majority of respondents to the survey (67.0%) have not or do not intend to take the EDRA exam (Fig. 4a), those who have attended the Course are more likely to consider taking the exam as compared to those who have not attended the Course ($p = 0.002$) (Fig. 4b).

Discussion

The main findings of this survey were that anesthesiologists who have attended the RA Course are more knowledgeable regarding the performance of peripheral blocks with neurostimulation and/or US guidance as compared to those who have not attended the Course. Attendees are also less likely to practice exclusively general anesthesia in their hospitals, more likely to attempt RA techniques and the insertion of peripheral nerve catheters and more likely to consider taking the EDRA exam as opposed to non-attendees. Both cohorts consider the Course of value and agree that the main reason for applying RA techniques is to ensure superior postoperative analgesia and that the main barrier in RA practice is the lack of relevant education in the techniques.

Our study also highlighted some interesting findings regarding RA pattern of practice. The majority of respondents declared that their technique of choice for lower extremity surgery is a neuraxial block as opposed to a peripheral block, with no difference between attendants and non-attendants of the Course. The ease of use, fast learning curve, high success rate of neuraxial blockade and broad exposure of residents to obstetric anesthesia with the preponderance of neuraxial approaches in it may underlie this finding [12–20]. This fact has been emphasized especially in older surveys. Some years ago, anesthesiology residents were much more likely to perform neuraxial blocks versus PNBs during their training years, while the former seem to be better assimilated than PNBs during residency training [6, 16]. Hadzic et al, showed that only 50% of anesthesiologists rated their training in PNBs as adequate, while those working at educational institutions apply PNBs more often [15]. Additionally, residents frequently reported limited access to PNBs during their training or failed to perform the minimum caseload of PNBs recommended by accreditation bodies [21, 22]. In another study evaluating confidence levels, residents at the end of their training did not report confidence in performing PNBs, in which they have little exposure [14]. Apparently, some years ago there seemed to be a gap in the teaching of PNBs and the number of PNBs performed during training was far less than the number of neuraxial blocks, perhaps reflecting the fact that neuraxial techniques were better mastered by the teachers themselves and therefore the most taught. This created a substantial problem however; confidence is a substantial factor in one's ability to continue to perform blocks beyond residency and if graduating residents feel inadequately prepared for a variety of regional techniques, they will hardly use techniques in which they lack expertise [23–26]. In other words, lost training opportunities during residency can lead to graduates failing to incorporate respective techniques into future practice [27]. Consequently, infrequent use at consultant level makes attaining and retaining proficiency difficult, therefore it is of paramount importance that education in RA continuous post residency so that the pool of experienced teachers increases and stays abreast of the latest advances. Another aspect of the same problem is the fact that traditionally and before the era of US, PNBs for the lower extremities were practiced less frequently and were considered technically more demanding and cumbersome because of the need of the performance of multiple blocks to anesthetize

the entire limb, whereas this was not the case for peripheral blocks of the upper extremity. This trend has been reported in various surveys [6, 8, 15, 22, 28, 29]. Additionally, neuraxial anesthesia in which anesthesiologists feel more confident as mentioned above, is usually a viable alternative for lower extremity surgery, whereas there is no alternative for upper extremity blocks. It appears though according to more recent surveys that lower extremity PNBs are gaining ground over upper extremity techniques and have now an upgraded role in clinical practice [30, 31]. Nowadays, we are witnessing an increasing trend of PNBs use over neuraxial blocks especially in orthopedics and the focus of training has shifted accordingly [31–33]. The advent and more universal application of US, which offers the ability to visualize neural structures in relation to surrounding tissues, needle advancement in real time and local anesthetic spread around nerves as well as today's emphasis on ambulatory surgery and "fast-tracking" of patients might have accounted for this tendency of equilibration [34, 35]. Although the enhanced popularity of PNBs in recent years has been substantiated in other regions, it appears that this is not the case in the Greek territory as yet. According to the results of our survey, it seems that more needs to be done to fill the gap in confidence related to PNBs, to remedy training deficits and to shift the focus of RA education from neuraxial to PNBs in accordance to international trends and recommendations for a diverse case mix in training programs.

The popularity of central nerve blocks was confirmed in this survey and is in accordance to the results of the previous survey performed in the Greek region [10] since the majority of anesthesiologists who responded to the survey ascertained their very good level of knowledge in central blocks, which did not seem to be affected by the attendance of the Course. Greek anesthesiologists also often use epidural catheters for the provision of postoperative analgesia, whereas this practice is not affected by the attendance or not of the Course either. This is in accordance with an older survey highlighting the popularity of epidural catheter use in Greek Anesthesia Departments [36]. Nevertheless, this is not the case regarding the use of peripheral nerve catheters, since a high percentage of respondents do not use this form of postoperative analgesia. It appears though that the attendance of the Course has an impact on the use of peripheral nerve catheters as there are significant differences in the use of peripheral catheters between attendants and non-attendants.

The benefits of regional block performance under US are multiple and include among others reliable nerve localization, improved local anesthetic spread and block success rate, decreased block performance time, facilitation of block placement in patients with challenging anatomy, overall decreased local anesthetic volume, improved safety and patient comfort [37–41]. US-guided techniques have enhanced our ability to achieve effective and consistent blocks and implementation of US guidance has been hailed as the new gold standard as far as efficacy and safety are concerned [42]. The main barriers to US use, both at an institutional and personal level, are unavailability of equipment and lack of training [42–44]. The cost-effectiveness of US-guided regional nerve blocks in comparison to landmark techniques has also been noted [45]. However, respondents to our survey overall confirmed that their knowledge of US application in peripheral block performance is inferior to using neurostimulation guidance in the performance of such blocks and that their knowledge and use of US in central block performance is much more inferior to the performance of central blocks with anatomical landmarks only.

It is common knowledge that US-focused workshops play a vital role in the acquisition of the necessary skills to both safely and effectively practice RA techniques under US guidance [46]. It has been emphasized that three major components are an integral part of achieving expertise in US-guided RA: understanding the equipment, recognition of anatomical structures and technical skills associated with needle placement encompassing the development of hand-eye coordination and needle visualization dexterity [47]. The gradual development of factual knowledge and motor skills is essential for residents and anesthesiologists in post-residency posts alike, while the integration of multiple technical and cognitive skills is necessary to achieve proficiency in the long term [26]. The Greek RA Course seems to fulfil some of these goals since, according to the results of this survey, attendees of the RA Workshop ascertained that the Workshop contributed significantly to the acquisition of the theoretical knowledge in all aspects of RA, including the basics of US guidance for nerve localization. Therefore, the Course seems to fulfil (at least partially) the knowledge gap of training opportunities in the Greek region.

However, the majority of participants in the Course, by stating that the Course changed their practice only a little, seem to be reluctant to universally incorporate US use in their everyday routine, admitting that even after the Course, they lack the confidence in broad US application and implementation in their daily practice. It appears therefore that despite the intensive structure of the Greek RA Workshop and an attempt from the instructors to teach the basics of the aforementioned three components, participants feel that more is needed in terms of quantity of learning so that key competencies taught can safely be extrapolated to the clinical realm and true day-to-day incorporation of RA in routine practice can be achieved [48]. In a study by Barrington and colleagues, in which the authors examined the amount of training required for naïve learners to identify the necessary anatomy for ultrasound-guided axillary block, they deduced that sonographic competence was achieved after eight to ten practice sessions [49]. According to Kopacz, confidence in RA techniques stems from two sources; first wondering whether the correct steps are being performed and secondly wondering whether the suitable endpoints are being achieved [50]. Both sources can be addressed by the appropriate amount of training, a fact consistent with the recommendations put forth by the ASRA and ESRA Joint Committee [51]. It appears therefore that more teaching time, including frequent exposure to learning opportunities and learning aids that help shorten a trainee's learning curve (peer-to-peer learning, participation in e-learning modules and hands-on Workshops), are required to bring naïve learners from baseline to competence and to enable them to effectuate a change in practice [28, 52, 53]. It has also been shown that repetitive opportunities are essential to reinforce learning and enable the acquisition of procedural skills [54]. This was actually reflected in participants' replies when asked to provide written feedback and make suggestions towards improvement of the Course in the only free-text question of the survey, where many people suggested expanding time allocated in US hands-on practice and application. This might be of particular importance in the case of US use for the performance of the central blocks as, according to our survey, the adoption of US as an aid in the performance of central blocks considerably lags behind US use for peripheral blocks and most respondents never or seldom use it for neuraxial anesthesia. This discrepancy has been highlighted in other studies and efforts towards its reversal could provide a valuable tool in the anesthesiologists' armamentarium when facing patients with challenging anatomy and generally in

cases where one might consider aborting the effort for regional anesthesia [25, 44, 55]. In fact, with more recent technological advances, the use of US has been expanded to include guiding more technically demanding procedures, such as neuraxial blockade.

Still, it appears that the Course, despite its weaknesses, created the foundation for the consolidation of basic knowledge in the performance of central and peripheral blocks via US guidance. Participants had statistically significant gains in knowledge as compared to non-attendees. Additionally, despite the aforementioned difficulties, it seems that the Course fulfils the target of familiarizing participants with RA practice, by creating interest and motivation in the use of RA procedures and perhaps enabling long-term retention of skills taught. In fact, as it was shown in our survey, anesthesiologists who have attended the Workshop are less likely to administer exclusively general anesthesia and more likely to use all types of anesthetic techniques and in particular peripheral blocks for lower limb surgery as opposed to those who have not attended the Course and the differences were statistically significant. Training can act as a major driving factor on the application of RA [14]. It appears therefore that the Course provides participants with the opportunity to acquire new skills, to develop a larger repertoire of techniques and to return to their clinical settings with new knowledge and strategies and thus to be more conducive to expanding their practice.

Anesthesiologists nowadays realize the importance of training in acquiring the requisite skills for the safe and effective practice of RA and the requirement for formal structured training programs towards achieving this goal. Teaching has been shown to dramatically increase the number of blocks performed and anesthesiologists have realized that didactic teaching can supply them with a basic framework of factual knowledge [24, 52]. This is reflected in our survey since the vast majority of people who attended the Course (almost 90%) attested that they did so in order to improve knowledge and skills in RA. Another noteworthy finding of the study is that all respondents to the survey consider that the RA Course contributes to Greek Anesthesiologists' education with no difference between attendants and non-attendants. It seems that the Course is quite popular and people who have not attended it also rate it highly and attribute non-attendance to their busy work schedule and lack of time. It appears that anesthesiologists' attitude has changed in recent years towards seeking high quality education activities, therefore they highly value opportunities for structured hands-on training.

The general view of respondents regarding reasons for performing regional techniques is in accordance to other studies. In fact, the notion that the main reason to use RA is to provide optimal postoperative analgesia has barely changed throughout the years [56]. On the other hand, respondents identified the lack of training as the major hindrance for broader RA application in everyday practice, a fact that has been extensively pinpointed in other studies [6, 57]. It is of interest that in an older study performed in the UK, the main barrier to RA was the length of time required to establish the block [56]. It appears that the realization of today's training opportunities along with the considerable assistance of novel techniques aiding in the performance of regional blocks and in the reduction of performance time account for this change in mindset. In our survey, surgeon and time-related reasons took the second and third place as key barriers in the performance of RA. Interestingly, the percentage corresponding to reluctance from

surgeons is higher than the one corresponding to reluctance from patients. Lack of support from surgeons and erroneous perceptions are ongoing institutional challenges. A survey of Canadian orthopedic surgeons revealed that only 40% of them directed their patients towards RA [58]. Surgeons not in favor were most probably unfamiliar with the benefits of PNBs and thought that RA is a complex procedure, which results in delays and unpredictable success rates with possible conversion to general anesthesia. In such situations, it has been shown that the availability of designated block rooms can expedite operating room flow, provide an unhurried and less stressful environment for teaching, reduce delays between cases and overcome logistical impediments in fast-paced clinical environments and high-volume institutions, where rapid turnover of cases is of the essence [59, 60]. As to the availability of Intralipid, which is crucial in the management of LAST, the fact that Intralipid was stored in only 70% of the Hospitals according to the replies provided, shows that more needs to be done to create awareness about LAST and to conform to current recommendations that a lipid rescue kit should be available in any setting in which RA is practiced [61].

Finally, it is perhaps unsurprising that anesthesiologists who have attended the Course have a greater intention to attempt taking the EDRA Diploma in comparison to those who have not. This is in accordance with the fact that anesthesiologists who attended the Course are less likely to administer solely general anesthesia and more likely to work in orthopedic hospitals where a variety of regional techniques are attempted. Anesthesiologists who have attended the Course seem to be more interested in acquiring an extra accreditation related to regional anesthesia career-wise and in proving that their knowledge encompasses the field of RA, since proof of RA expertise may have employment implications [53]. Therefore, the willingness to take the exam may be an indirect indication of greater motivation for a RA qualification.

A limitation of the current survey, as with other surveys of this kind, is the non-respondent bias. There is always a risk of bias caused by clinicians left out of the survey, as anesthesiologists with little interest in RA might have not shown interest in completing a questionnaire forwarded by a RA Society. Although we took measures to optimize the response rate, we do not know whether non-respondents would have answered in the same manner as respondents. Another limitation is the fact that expertise or lack thereof was based on self-estimation and therefore, participants' perception of competency and of procedural performance was subjective. The objective estimation of expertise cannot be based on a survey tool but rather requires systemic theoretical and practical evaluation of respondents, which however was beyond the scope of the current study. Finally, our survey is a cross-sectional study, not reflecting the longitudinal changes in training. Our survey though has many strengths. First, we achieved a satisfactory response rate (over 50% of the targeted individuals), within the range of previously published similar surveys [6, 9, 15, 19]. Therefore, we consider we provided useful insight into nationwide practice of RA and evaluation of the RA hands-on Workshop. It has been recommended that the minimal number of survey responses required for survey validity equals the number of questions times 10 [62]. The current 33-question survey required at least 330 responses and we received 424, which is a reasonable response rate. Notably, the anonymous design chosen reduces reservations to respond and to provide idealized answers, resulting in self-report bias. Additionally, questionnaires without a lot of open questions maximize response rate.

Secondly, the majority of responders were consultants with > 10 years of experience in anesthesiology, which implies high reliability of the data. Finally, we consider that we obtained representative information about practice and opinions in the whole country since we had responses from a variety of health institutions from across all regions of Greece, including academic and non-academic centers, community hospitals and private practice settings. Therefore, this preliminary exploratory survey could create the basis for future comparisons and could be an important step towards future European or international initiatives using validated questionnaires to assess the impact of other educational activities in the field of RA in wider geographical scopes.

In conclusion, the results of the current survey highlight that despite its weaknesses, a dedicated RA Course may increase subsequent RA practice by concentrating learning experience into a focused period. At a national level, future advances in RA will be highly dependent on the quality of education. In the previous survey about RA practice in Greece the lack of a formal stepwise program incorporated in the curriculum of residency had been emphasized as a significant shortcoming to systematic training in RA techniques [10]. In the last couple of years, the situation has changed as relevant administrative authorities have realized the importance of standardized training and formalized teaching programs in many medical specialties including anesthesiology. Training programs have started moving away from apprenticeship models which prevailed in the last several decades and provided inconsistent learning experiences towards competency-based methods of education. Thus, the curriculum of the specialty has been redesigned, amendments have been suggested, deficiencies have been identified and a structured program of specific rotations offering more targeted education in RA by incorporating formal RA rotations has now been officially integrated into the residency curriculum of Greek anesthesiologists. The aim is to make RA techniques an integral part of professional training during residency and to ensure trainees receive exposure to both conceptual knowledge and practical experience, which can significantly impact the utilization of the techniques post-residency. Hopefully this fact, along with the improvement of the present Course as well as future educational initiatives especially targeting PNBs, the follow up of innovations and especially the increased exposure to US teaching might greatly enhance the training process in RA by not only providing core skills but also by creating the basis for the implementation of a solid curriculum in RA training.

Abbreviations

ESRA European Society of Regional Anesthesia and Pain Therapy

ESRA Hellas Greek Chapter of the European Society of Regional Anesthesia and Pain Therapy

ASRA American Society of Regional Anesthesia and Pain Medicine

US Ultrasound

PNBs Peripheral Nerve Blocks

Declarations

Acknowledgements

The authors wish to thank all Greek anesthesiologists who made this study possible by responding to the questionnaire.

Special thanks to Mrs Kalliopi Platsi, Secretary of ESRA Hellas for her valuable secretarial assistance.

Author contributions

K.T. and E.S. were responsible for study conception and design. K.T. was responsible for analysis and interpretation of data and wrote the manuscript. E.M. and A.M. contributed to data collection and to the conduct of the study. All authors have approved the manuscript and are accountable for all aspects of the work.

Disclosures

Competing interests: The authors declare no competing interests

Funding: This research did not receive any specific grant from funding agencies

Ethical approval: This study was approved by the Institutional Review Board of the Aretaieion University Hospital, University of Athens School of Medicine, Athens, Greece

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request

References

1. Kessler, J., Marhofer, P., Hopkins, P.M. & Hollmann, M.W. Peripheral regional anaesthesia and outcome: lessons learned from the last 10 years. *Br. J. Anaesth.* **114**, 728-745 (2015)
2. Zywił, M.G., Prabhu, A., Perruccio, A.V. & Gandhi, R. The influence of anesthesia and pain management on cognitive dysfunction after joint arthroplasty: a systematic review. *Clin. Orthop. Relat. Res.* **472**, 1453-1466 (2014)
3. McIsaac, D.I., Cole, E.T. & McCartney, C.J. Impact of including regional anaesthesia in enhanced recovery protocols: a scoping review. *Br. J. Anaesth.* **115**, Suppl 2: ii 46-56 (2015)

4. Dockrell, L. & Buggy, D.J. The role of regional anaesthesia in the emerging subspecialty of onco-anaesthesia: a state-of-the-art review. *Anaesthesia***76**, Suppl 1:148-159 (2021)
5. Iwasaki, M., Edmondson, M., Sakamoto, A. & Ma, D. Anesthesia, surgical stress, and "long-term" outcomes. *Acta Anaesthesiol. Taiwan***53**, 99-104 (2015)
6. Corvetto, M., McCready, M., Cook, C., Pietrobon, R. & Altermatt, F. [Regional anesthesia practice in Chile: an online survey]. *Rev. Esp. Anesthesiol. Reanim***57**, 209-213 (2010)
7. Huang, J. & Gao, H. Regional anesthesia practice in China: a survey. *J. Clin. Anesth***34**, 115-123 (2016)
8. Corvetto, M.A. et al. Current practice in regional anaesthesia in South America: An online survey. *Rev. Esp. Anesthesiol. Reanim***64**, 27-31 (2017)
9. Heid, F., Jage, B. & Jage, J. Current practice in regional anaesthesia in Germany. *Eur. J. Anaesthesiol***23**, 346-350 (2006)
10. Argyra, E. et al. Regional anesthesia practice in Greece: A census report. *J. Anaesthesiol. Clin. Pharmacol***31**, 59-66 (2015)
11. Jones, D., Story, D., Clavisi, O., Jones, R. & Peyton, P. An introductory guide to survey research in anaesthesia. *Anaesth. Intensive Care***34**, 245-253 (2006)
12. Kopacz, D.J., Neal, J.M. & Pollock, J.E. The regional anesthesia "learning curve". What is the minimum number of epidural and spinal blocks to reach consistency? *Reg. Anesth***21**, 182-190 (1996)
13. Konrad, C., Schüpfer, G., Wietlisbach, M. & Gerber, H. Learning manual skills in anesthesiology: Is there a recommended number of cases for anesthetic procedures? *Anesth. Analg***86**, 635-639 (1998)
14. Smith, M.P., Sprung, J., Zura, A., Mascha, E. & Tetzlaff, J.E. A survey of exposure to regional anesthesia techniques in American anesthesia residency training programs. *Reg. Anesth. Pain Med***24**, 11-16 (1999)
15. Hadzić, A., Vloka, J.D., Kuroda, M.M., Koorn, R. & Birnbach, D.J. The practice of peripheral nerve blocks in the United States: a national survey. *Reg. Anesth. Pain Med***23**, 241-246 (1998)
16. Kopacz, D.J. & Bridenbaugh, L.D. Are anesthesia residency programs failing regional anesthesia? The past, present, and future. *Reg. Anesth***18**, 84-87 (1993)
17. Rosenblatt, M.A. & Fishkind, D. Proficiency in interscalene anesthesia-how many blocks are necessary? *J. Clin. Anesth***15**, 285-288 (2003)
18. Helayel, P.E. et al. Learning curve for the ultrasound anatomy of the brachial plexus in the axillary region. *Rev. Bras. Anesthesiol***59**, 187-193 (2009)
19. Chelly, J.E. et al. Training of residents in peripheral nerve blocks during anesthesiology residency. *J. Clin. Anesth***14**, 584-588 (2002)
20. Barrington, M.J., Wong, D.M., Slater, B., Ivanusic, J.J. & Ovens, M. Ultrasound-guided regional anesthesia: how much practice do novices require before achieving competency in ultrasound needle visualization using a cadaver model. *Reg. Anesth. Pain Med***37**, 334-339 (2012)

21. Hargett, M.J., Beckman, J.D., Liguori, G.A. & Neal, J.M. Guidelines for regional anesthesia fellowship training. *Reg. Anesth. Pain Med.***30**, 218-225 (2005)
22. Kopacz, D.J. & Neal, J.M. Regional anesthesia and pain medicine: residency training—the year 2000. *Reg. Anesth. Pain Med.***27**, 9-14 (2002)
23. Smith, H.M., Kopp, S.L., Jacob, A.K., Torsher, L.C. & Hebl, J.R. Designing and implementing a comprehensive learner-centered regional anesthesia curriculum. *Reg. Anesth. Pain Med.***34**, 88-94 (2009)
24. Tan, J.S., Chin, K.J. & Chan, V.W. Developing a training program for peripheral nerve blockade: the "nuts and bolts" *Int. Anesthesiol. Clin.***48**, 1-11 (2010)
25. Kopacz, D. QA in regional anesthesia training: quantity or quality? *Reg. Anesth.***22**, 209-11 (1997)
26. Slater, R.J., Castanelli, D.J. & Barrington, M.J. Learning and teaching motor skills in regional anesthesia: a different perspective. *Reg. Anesth. Pain Med.***39**, 230-239 (2014)
27. Ramlogan, R. 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.***35**, 224-226 (2010)
28. Hadzic, A., Vloka, J.D. & Koenigsamen, J. Training requirements for peripheral nerve blocks. *Curr. Opin. Anaesthesiol.***15**, 669-673 (2002)
29. Baydar, H. et al. Evaluation of education, attitude, and practice of the Turkish anesthesiologists in regional block techniques. *Anesth. Pain Med.***2**, 164-169 (2013)
30. Moon, T.S., Lim, E. & Kinjo, S. A survey of education and confidence level among graduating anesthesia residents with regard to selected peripheral nerve blocks. *BMC Anesthesiol.***13**, 16 (2013)
31. Neal, J.M., Gravel Sullivan, A., Rosenquist, R.W. & Kopacz, D.J. Regional Anesthesia and Pain Medicine: US Anesthesiology Resident Training-The Year 2015. *Reg. Anesth. Pain. Med.***42**, 437-441 (2017)
32. Cozowicz, C., Poeran, J., Zubizarreta, N., Mazumdar, M. & Memtsoudis, S.G. Trends in the Use of Regional Anesthesia: Neuraxial and Peripheral Nerve Blocks. *Reg. Anesth. Pain Med.* **41**, 43-49 (2016)
33. Patel, A.A. et al. National trends in ambulatory surgery for upper extremity fractures: a 10-year analysis of the US National Survey of Ambulatory Surgery. *Hand (N Y)***10**, 254-259 (2015)
34. Helwani, M.A., Saied, N.N., Asaad, B., Rasmussen, S. & Fingerman, M.E. The current role of ultrasound use in teaching regional anesthesia: a survey of residency programs in the United States. *Pain Med.***13**, 1342-1346 (2012)
35. Marhofer, P., Harrop-Griffiths, W., Kettner, S.C. & Kirchmair, L. Fifteen years of ultrasound guidance in regional anaesthesia: part 1. *Br. J. Anaesth.***104**, 538-546 (2010)
36. Tzavellas, P. et al. A survey of postoperative epidural and intravenous analgesia in Greece. *Eur. J. Anaesthesiol.***24**, 942-950 (2007)

37. Kapra, I. S. et al. Ultrasonographic guidance improves the success rate of interscalene brachial plexus blockade. *Reg. Anesth. Pain Med.***33**, 253-258 (2008)
38. Orebaugh, S.L, Williams, B.A. & Kentor, M.L. Ultrasound guidance with nerve stimulation reduces the time necessary for resident peripheral nerve blockade. *Reg. Anesth. Pain Med.***32**, 448-454 (2007)
39. Liu, S.S. Evidence Basis for Ultrasound-Guided Block Characteristics Onset, Quality, and Duration. *Reg. Anesth. Pain Med.***41**, 205-220 (2016)
40. Neal, J.M. Ultrasound-Guided Regional Anesthesia and Patient Safety: Update of an Evidence-Based Analysis. *Reg. Anesth. Pain Med.***41**, 195-204 (2016)
41. Barrington, M.J. & Kluger, R. Ultrasound guidance reduces the risk of local anesthetic systemic toxicity following peripheral nerve blockade. *Reg. Anesth. Pain Med.***38**, 289-299 (2013)
42. Hopkins, P.M. Ultrasound guidance as a gold standard in regional anaesthesia. *Br. J. Anaesth.***98**, 299-301 (2007)
43. Chui, J. et al. Identifying barriers to the use of ultrasound in the perioperative period: a survey of southwestern Ontario anesthesiologists. *BMC Health Serv. Res.* **19**, 214 (2019)
44. Neal, J.M. et al. The Second American Society of Regional Anesthesia and Pain Medicine Evidence-Based Medicine Assessment of Ultrasound-Guided Regional Anesthesia: Executive Summary. *Reg. Anesth. Pain Med.***41**, 181-194 (2016)
45. Ehlers, L., Jensen, J.M. & Bendtsen, T.F. Cost-effectiveness of ultrasound vs nerve stimulation guidance for continuous sciatic nerve block. *Br. J. Anaesth.***109**, 804-808 (2012)
46. Chin, K.J. & Chan, V. Ultrasound-guided peripheral nerve blockade. *Curr. Opin. Anaesthesiol.***21**, 624-631 (2008)
47. McCartney, C.J. & Mariano, E.R. Education in Ultrasound-Guided Regional Anesthesia: Lots of Learning Left to Do. *Reg. Anesth. Pain Med.***41**, 663-664 (2016)
48. Scholten, H.J, Pourtaherian, A., Mihajlovic, N., Korsten, H.H.M. & Bouwman, R.A. Improving needle tip identification during ultrasound-guided procedures in anaesthetic practice. *Anaesthesia***72**, 889-904 (2017)
49. Barrington, M.J. et al. Determining the Learning Curve for Acquiring Core Sonographic Skills for Ultrasound-Guided Axillary Brachial Plexus Block. *Reg. Anesth. Pain Med.***41**, 667-670 (2016)
50. Kopacz, D.J. Regional anesthesia training: do we have the confidence to go on? *Reg. Anesth. Pain Med.***24**, 1-4 (1999)
51. Sites, B.D. 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.***34**, 40-46 (2009)
52. Martin, G. et al. A new teaching model for resident training in regional anesthesia. *Anesth. Analg.***95**, 1423-1437 (2002)
53. 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.***40**, 213-217 (2015)
54. Ericsson, K.A. Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Acad. Med.***79**, S70-81 (2004)
 55. Chin, K.J. et al. Ultrasound imaging facilitates spinal anesthesia in adults with difficult surface anatomic landmarks. *Anesthesiology***115**, 94-101 (2011)
 56. Buist, R.J. A survey of the practice of regional anaesthesia. *J. R. Soc. Med.***83**, 709-712 (1990)
 57. Hanna, M.N. et al. Survey of the utilization of regional and general anesthesia in a tertiary teaching hospital. *Reg. Anesth. Pain Med.* **34**, 224-228 (2009)
 58. Oldman, M. et al. A survey of orthopedic surgeons' attitudes and knowledge regarding regional anesthesia. *Anesth. Analg.***98**, 1486-1490 (2004)
 59. Armstrong, K.P. & Cherry, R.A. Brachial plexus anesthesia compared to general anesthesia when a block room is available. *Can. J. Anaesth.* **51**, 41-44 (2004)
 60. Chin, A., Heywood, L., Lu, P., Pelecanos, A.M. & Barrington, M.J. The effectiveness of regional anaesthesia before and after the introduction of a dedicated regional anaesthesia service incorporating a block room. *Anaesth. Intensive Care***45**, 714-719 (2017)
 61. Neal, J.M., Neal, E.J. & Weinberg, G.L. American Society of Regional Anesthesia and Pain Medicine Local Anesthetic Systemic Toxicity checklist: 2020 version. *Reg. Anesth. Pain Med.***46**, 81-82 (2021)
 62. Fincham, J.E. Response rates and responsiveness for surveys, standards, and the Journal. *Am. J. Pharm. Educ.***72**, 43 (2008)

Tables

Table 1. Demographics of respondents; NHS, National Health System; results are presented as number (percentage %)

Questions	Responses (N=424)
You are a:	
-resident/trainee	57 (13.4)
-consultant with < 5 years of experience	75 (17.7)
-consultant with 5-10 years of experience	111 (26.2)
-consultant with >10 years of experience	181 (42.7)
You work in a:	
-central NHS Hospital	143 (33.7)
-district NHS Hospital	88 (20.8)
-central University Hospital	34 (8.0)
-district University Hospital	29 (6.8)
-military Hospital	25 (5.9)
-central private Hospital	70 (16.5)
-district private Hospital	26 (6.1)
-other institutions	9 (2.1)
In the Hospital where you work:	
-mainly general anesthesia is performed	46 (10.8)
-general anesthesia and neuraxial blocks are performed	141 (33.3)
-general anesthesia, neuraxial blocks and peripheral blocks with neurostimulation are performed	66 (15.6)
- general anesthesia, neuraxial blocks and peripheral blocks with both neurostimulation and ultrasound are performed	171 (40.3)
The percentage of operations under regional anesthesia in your Hospital is:	
-<10%	10 (2.4)
-10-20%	84 (19.8)
-20-30%	120 (28.3)
-31-50%	130 (30.6)
->50%	80 (18.9)
The available equipment on your Hospital for the performance of regional anesthesia techniques is:	
-neurostimulator	89 (21.0)
-ultrasound machine	27 (6.4)
-both neurostimulator and ultrasound machine	242 (57.0)
-none	66 (15.6)
Is there a local anesthetic toxicity kit in your Hospital?	
-yes	296 (69.8)
-no	110 (26.0)
- I don't know what this is	18 (4.2)
Do you know about the Regional Anesthesia Course?	
-yes	402 (94.8)
-no	22 (5.2)
Have you attended the Regional Anesthesia Course?	
-yes	189 (44.6)
-no	235 (55.4)

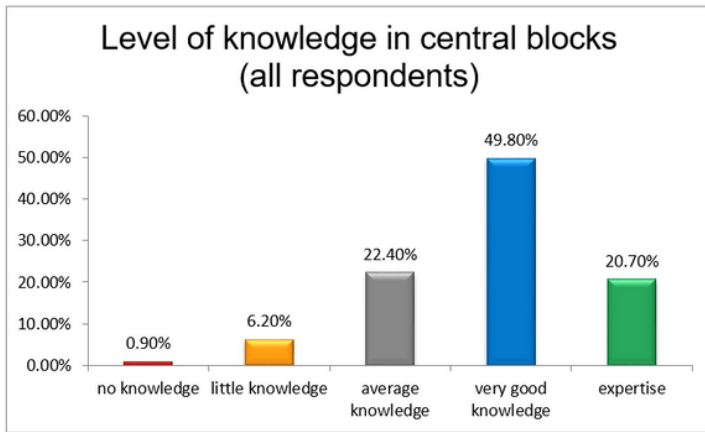
Table 2. Views and attitudes of anesthetists who attended the Course; EDRA, European Diploma in Regional Anesthesia; results are presented as number (percentage %)

Questions	Responses (N=189)
Reason for attending the Course	
-to improve CV	7 (3.7)
-to improve knowledge and skills in regional anesthesia	169 (89.4)
- because of intention to take the EDRA exam	13 (6.9)
How much did the Course contribute to knowledge about central blocks?	
-not at all	6 (3.2)
-a little	41 (21.7)
-considerably	111 (58.7)
-a lot	31 (16.4)
How much did the Course contribute to knowledge about central blocks with ultrasound guidance?	
-not at all	26 (13.8)
-a little	68 (36.0)
- considerably	77 (40.7)
-a lot	18 (9.5)
How much did the Course contribute to knowledge about peripheral blocks with neurostimulation?	
-not at all	16 (8.5)
-a little	74 (39.1)
-considerably	87 (46.0)
-a lot	12 (6.3)
How much did the Course contribute to knowledge about peripheral blocks with ultrasound guidance?	
-not at all	14 (7.4)
-a little	46 (24.4)
-considerably	94 (49.7)
-a lot	35 (18.5)
How much did the Course change your practice afterwards?	
-not at all	29 (15.3)
-a little	87 (46.0)
-considerably	61 (32.3)
-a lot	12 (6.4)
After the Course and the experience you got from it, have you started performing blocks with ultrasound guidance?	
-yes (I was already performing)	44 (23.3)
-yes, I got more confidence	43 (22.7)
-no, I still lack the confidence	48 (25.4)
-no, there is lack of equipment in my Hospital	44 (23.3)
-no, no suitable operations in my Hospital (i.e. orthopedics)	10 (5.3)
Did the Course lead to efforts to acquire equipment for regional anesthesia techniques?	
-yes	112 (59.2)
-no	71 (37.6)
-equipment already available	6 (3.2)
After your personal experience, would you recommend the attendance of the Course?	
-yes	167 (88.4)
-no	22 (11.6)
After your personal experience, do you think the Course contributes to regional anesthesia education of Greek anesthetists?	
-not at all	1 (0.5)
-a little	28 (14.8)
-considerably	110 (58.2)
-a lot	50 (26.5)

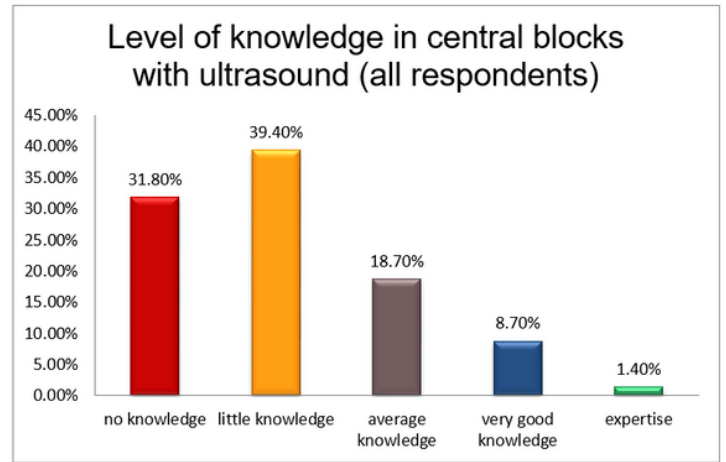
Table 3. Personal practice of respondents in aspects of regional anesthesia techniques; results are presented as number (percentage %); P value for the comparison between students who attended and did not attend the Course; bold numerals denote a significant difference between people who attended the Regional Anesthesia Course and those who did not ($P < 0.05$)

	All respondents (N=424)	People who attended the Regional Anesthesia Course (N=189)	People who did not attend the Regional Anesthesia Course (N=235)	p-value
Personal practice in anesthesia provision				
-mainly general anesthesia	49 (11.5)	10 (5.3)	39 (16.6)	<0.001
-general anesthesia and central blocks	169 (39.8)	75 (39.7)	94 (40.0)	
-general anesthesia, central blocks and peripheral, blocks with neurostimulation	63 (14.8)	27 (14.3)	36 (15.3)	0.873
-general anesthesia, central blocks and peripheral blocks with both neurostimulation and ultrasound	144 (33.9)	77 (40.7)	66 (28.1)	0.008
Personal practice in peripheral blocks				
-use of ultrasound (confidence and expertise)	128 (30.2)	79 (41.8)	49 (20.9)	<0.001
-use of neurostimulation (lack of confidence and expertise in ultrasound)	66 (15.6)	26 (13.8)	40 (17.0)	
-use of neurostimulation (no ultrasound machine available)	35 (8.3)	15 (7.9)	20 (8.5)	0.971
-use of anatomic landmarks only	4 (0.9)	1 (0.5)	3 (1.3)	0.775
-no peripheral blocks (no confidence, do not know the technique)	132 (31.1)	52 (27.5)	80 (34.0)	0.181
-no peripheral blocks (no suitable operations in my Hospital)	59 (13.9)	16 (8.5)	43 (18.3)	0.006
Personal practice in lower limb surgery				
-neuraxial block	141 (33.2)	63 (33.3)	78 (33.2)	0.942
-peripheral block	133 (31.4)	71 (37.6)	62 (26.4)	0.018
-general anesthesia	84 (19.8)	34 (18.0)	50 (21.3)	0.471
-no lower limb surgery in my Hospital	66 (15.6)	21 (11.1)	45 (19.1)	0.033
Epidural catheters				0.176
-often	307 (72.4)	138 (73.0)	169 (71.9)	
-occasionally	90 (21.2)	42 (22.2)	48 (20.4)	
-never	11 (2.6)	6 (3.2)	5 (2.1)	
-I do not do epidurals	16 (3.8)	3 (1.6)	13 (5.6)	
Catheters in peripheral nerve blocks				<0.001
-never	176 (41.5)	68 (36.0)	108 (46.0)	
-yes, for 24 hours	25 (5.9)	23 (12.1)	2 (0.8)	
-yes, for 2-3 days	32 (7.6)	30 (15.9)	2 (0.8)	
-I do not perform peripheral blocks	191 (45.0)	68 (36.0)	123 (52.4)	
Main reasons for performing regional anesthesia				0.573
-regional anesthesia is safe	79 (18.6)	34 (18.0)	45 (19.1)	
-regional anesthesia improves outcome	48 (11.3)	25 (13.2)	23 (9.8)	
-regional anesthesia decreases cost of hospitalization	17 (4.0)	5 (2.6)	12 (5.1)	
-regional anesthesia decreases the incidence of complications	42 (9.9)	19 (10.1)	23 (9.8)	
-regional anesthesia ensures superior postoperative analgesia	208 (49.1)	90 (47.6)	118 (50.2)	
-all of the above	30 (7.1)	16 (8.5)	14 (6.0)	
Obstacles in performing regional anesthesia				0.991
-lack of education	287 (67.7)	127 (67.2)	160 (68.1)	
-time-consuming	62 (14.6)	29 (15.3)	33 (14.0)	
-patients negative	22 (5.2)	9 (4.8)	13 (5.5)	
-surgeons negative	45 (10.6)	21 (11.1)	24 (10.2)	
-high percentage of lack of success	3 (0.7)	1 (0.5)	2 (0.9)	
-significant percentage of complications	5 (1.2)	2 (1.1)	3 (1.3)	

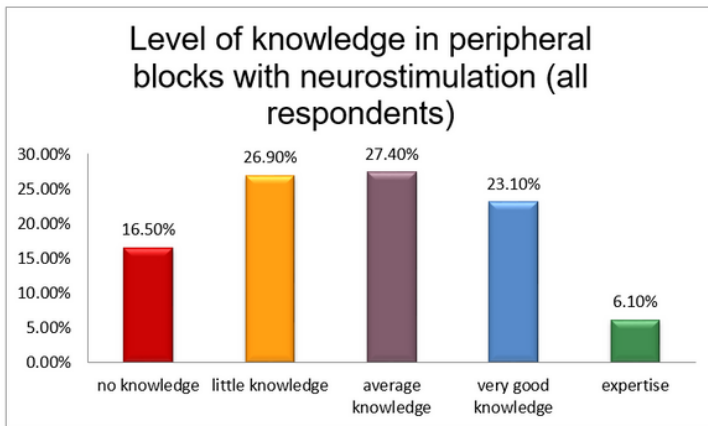
Figures



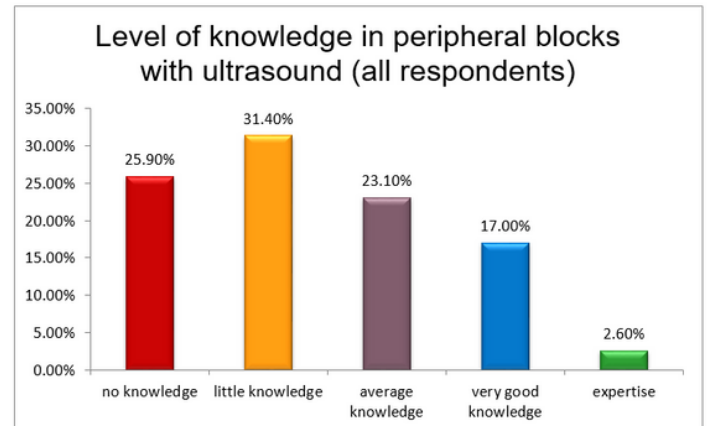
a



b



c



d

Figure 1

a. Level of knowledge in central blocks (all anesthesiologists who responded to the survey) b. Level of knowledge in central blocks with ultrasound guidance (all anesthesiologists who responded to the survey) c. Level of knowledge in peripheral blocks with neurostimulation (all anesthesiologists who responded to the survey) d. Level of knowledge in peripheral blocks with ultrasound guidance (all anesthesiologists who responded to the survey)

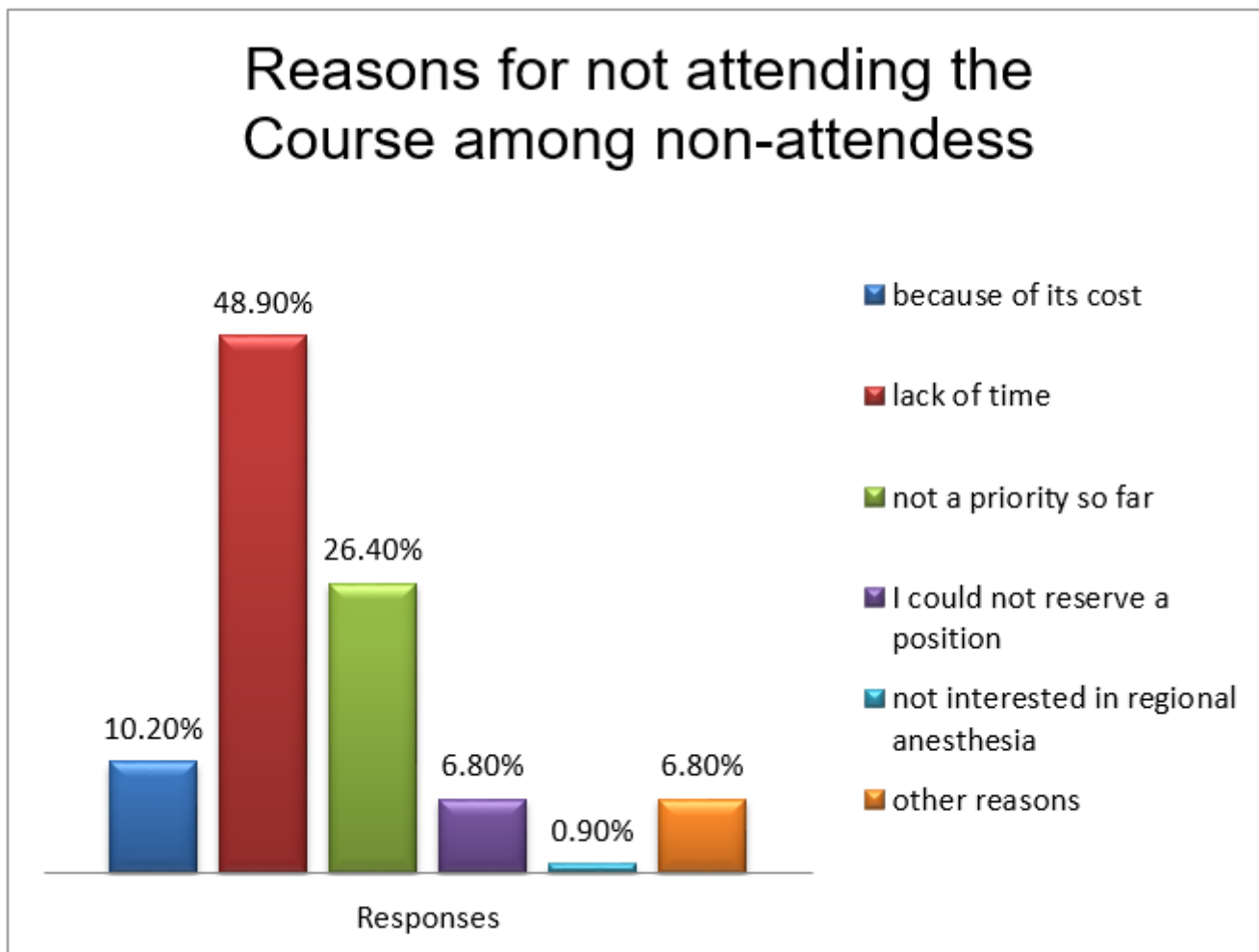


Figure 2

Reasons for not attending the Regional Anesthesia Course among anesthesiologists who have not attended the Course

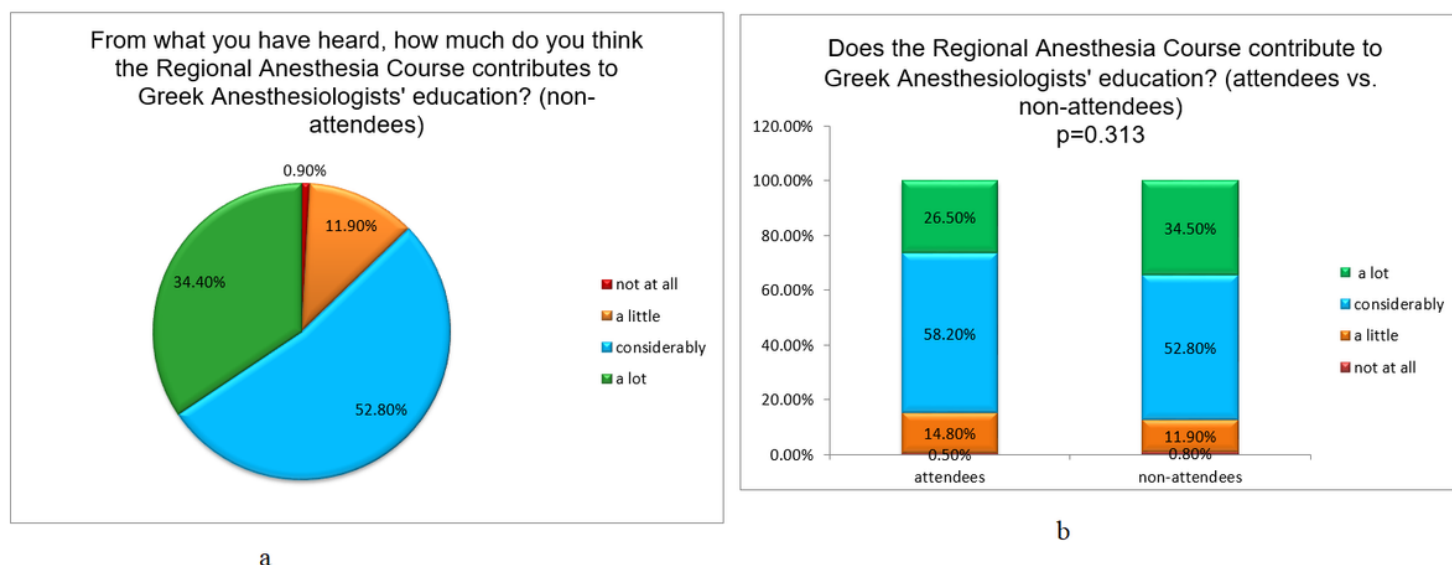


Figure 3

a. Contribution of the Course to regional anesthesia education of Greek anesthesiologists according to people who have not attended the Regional Anesthesia Course b. Contribution of the Course to regional anesthesia education of Greek anesthesiologists (attendants versus non-attendants of the Regional Anesthesia Course)

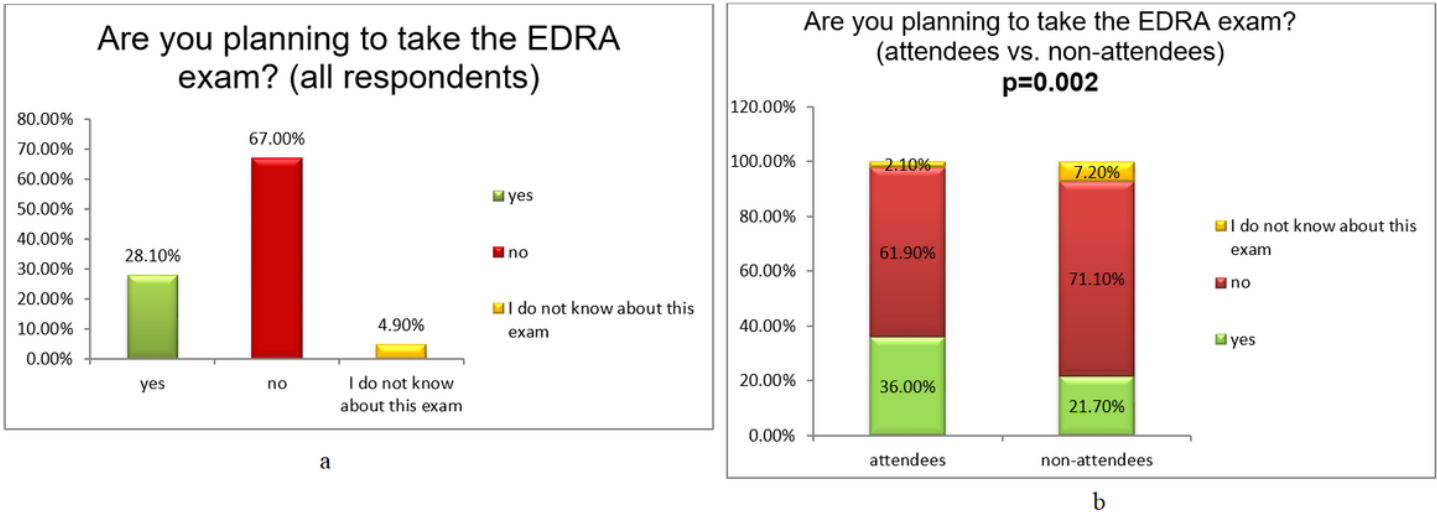


Figure 4

a. Willingness to take the European Diploma of Regional Anesthesia (EDRA) exam (all anesthesiologists who responded to the survey) b. Willingness to take the European Diploma of Regional Anesthesia (EDRA) exam (attendants versus non-attendants of the Regional Anesthesia Course)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Appendix.docx](#)